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Santa Clara, CA 95054

Using the Bay Command Console (BCC)

NORTEL NETWORKS™

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Preface

The BCC is a command-line interface for configuring Nortel Networks™ devices. If you are responsible for configuring and managing Nortel Networks AN®, ANH™, ARN™, ASN™, BN® (BCN® and BLN®), or System 5000™ routers, read this guide to learn how to use the Bay Command Console (BCC™).

Before You Begin

This guide is intended for users who have some experience supporting a multivendor internetworking system. You should be able to perform network device configuration, maintenance, and troubleshooting.

Because the BCC makes real-time changes to device configuration, Nortel Networks recommends that you first learn about BCC behavior on a device not connected to your production network.

Make sure that you are running the latest version of Nortel Networks BayRS™. See the release and upgrading publications for information on how to upgrade to the latest version.

Text Conventions

This guide uses the following text conventions:

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: If the command syntax is: **ping** *<ip_address>*, you enter: **ping 192.32.10.12**
bold text	Indicates command names and options and text that you need to enter. Example: Enter **show ip {alerts | routes}**. Example: Use the **dinfo** command.
braces ({})	Indicate required elements in syntax descriptions where there is more than one option. You must choose only one of the options. Unless explicitly instructed to do so, do not type the braces when entering the command. Example: If the command syntax is: **show ip {alerts | routes}**, you must enter either: **show ip alerts** or **show ip routes**, but not both. If the command sets a parameter value consisting of multiple elements, you must type the braces as part of the command if instructed to do so. Example: **severity-mask {fault warning info}**
brackets ([ ])	Indicate optional elements in syntax descriptions. Do not type the brackets when entering the command. Example: If the command syntax is: **show ip interfaces [-alerts]**, you can enter either: **show ip interfaces** or **show ip interfaces -alerts**.

ellipsis points (. . .)	Indicate that you repeat the last element of the command as needed. Example: If the command syntax is: **ethernet/2/1** [*<parameter> <value>*] **. . .** , you enter **ethernet/2/1** and as many parameter-value pairs as needed.
italic text	Indicates file and directory names, new terms, book titles, and variables in command syntax descriptions. Where a variable is two or more words, the words are connected by an underscore. Example: If the command syntax is: **show at** *<valid_route>* *valid_route* is one variable and you substitute one value for it.
`screen text`	Indicates system output, for example, prompts and system messages. Example: `Set Nortel Networks Trap Monitor Filters`
separator (>)	Shows menu paths. Example: Protocols > IP identifies the IP option on the Protocols menu.
vertical line (|)	Separates choices for command keywords and arguments. Enter only one of the choices. Do not type the vertical line when entering the command. Example: If the command syntax is: **show ip {alerts | routes}**, you enter either: **show ip alerts** or **show ip routes**, but not both.

Acronyms

This guide uses the following acronyms:

ARP	Address Resolution Protocol
ATM	asynchronous transfer mode
BCC	Bay Command Console
BofL	Breath of Life
DCM	data collection module
DRAM	dynamic random access memory
IP	Internet Protocol
IPX	Internetwork Packet Exchange
LAN	local area network
MAC	media access control
NVRAM	nonvolatile random access memory
OSPF	Open Shortest Path First
RIP	Routing Information Protocol
SNMP	Simple Network Management Protocol
SRM-L	system resource module-link
TCP/IP	Transmission Control Protocol/Internet Protocol
TFTP	Trivial File Transfer Protocol
WAN	wide area network

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Sydney, Australia	61-2-9927-8800
Tokyo, Japan	81-3-5402-7041

Chapter 1
Overview of the BCC

The BCC is a command-line interface for configuring Nortel Networks devices. After logging on to a device, you access the BCC by entering the **bcc** command at the Technician Interface prompt (Figure 1-1).

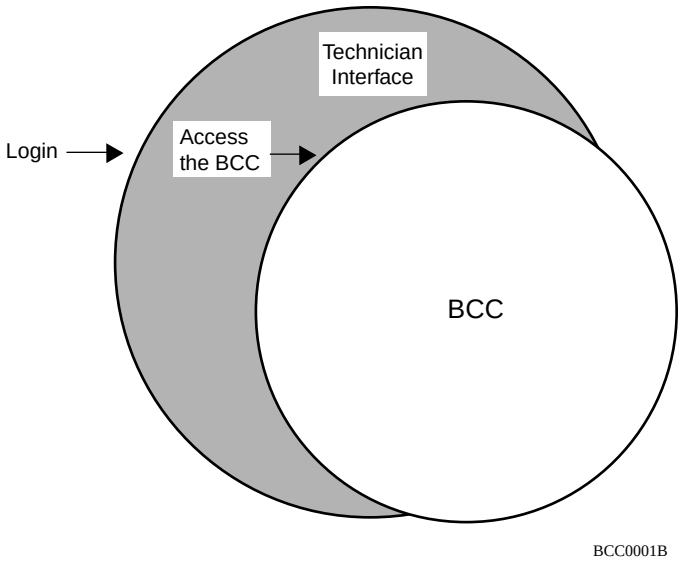


Figure 1-1. The Technician Interface and the BCC Interface

From the BCC prompt, you can:

- Execute any system command not classified as “Technician Interface only” (see Appendix B, “System Commands”).
- Execute configuration commands to perform tasks such as creating or deleting IP interfaces on the router. Enter BCC configuration mode by entering the **config** command at the BCC prompt.

Note: For a list of services you can configure using the BCC, see the *Release Notes*. You can obtain a complete hierarchical listing of all objects configurable on a device by entering the **help tree -all** command at any BCC prompt.

Platform Requirements

The BCC runs on AN, ANH, ARN, ASN, System 5000, and BN platforms including ARE, FRE®, and FRE-2 processor modules. Each slot must have:

- 16 MB of dynamic RAM (DRAM)
- 2 MB of free memory space available when you start the BCC

If you try to start the BCC with insufficient DRAM or free memory on a slot, the BCC returns an error message. In that case, use Site Manager instead of the BCC.

Number of BCC Sessions

You can open one BCC session per slot in read-write (configuration) mode. Other users can open additional BCC sessions in read-only (nonconfiguration) mode on the same slot, depending on available memory. Each BCC session is mutually exclusive. If you make a change during a BCC session in read-write mode, this change does not appear in other BCC sessions.

Multilevel Access

Multilevel access adds a third login level, that of Operator, to the existing Manager and User login levels of the BCC. With multilevel access, multiple users (each with a distinct user name and password), can access the router simultaneously.

Multilevel access allows you to:

- Add multiple user names, passwords, and access privileges to the router.
- Manage the distribution of user names, passwords, and access privileges from the BCC.
- View event logs showing each BCC command issued and the user responsible for issuing the command.

For more information on how to configure and use multilevel access features, refer to Appendix A, "Multilevel Access." For a list of system commands and the privilege level required to execute them, refer to Appendix B, "System Commands."

Terminology and Concepts

This section describes key terms and concepts of the BCC interface.

Configuration Hierarchy

The BCC configuration hierarchy begins at a root-level object, called *box* for AN/ANH, ARN, and BN platforms, and *stack* for ASN and System 5000 platforms. Under the root-level object are branch objects such as interfaces and protocols that fan out from root level in a tree hierarchy.

You use the **help tree -all** and **show config -all** commands to display the configuration hierarchy of a Nortel Networks router:

- The **help tree -all** command displays the hierarchy of every object you can configure. (These are the configuration choices you can make. These are not objects already configured.)
- The **show config -all** command displays the hierarchy of objects you have actually configured.

Figure 1-2 illustrates a sample BCC configuration for an AN, BN, or ARN router.

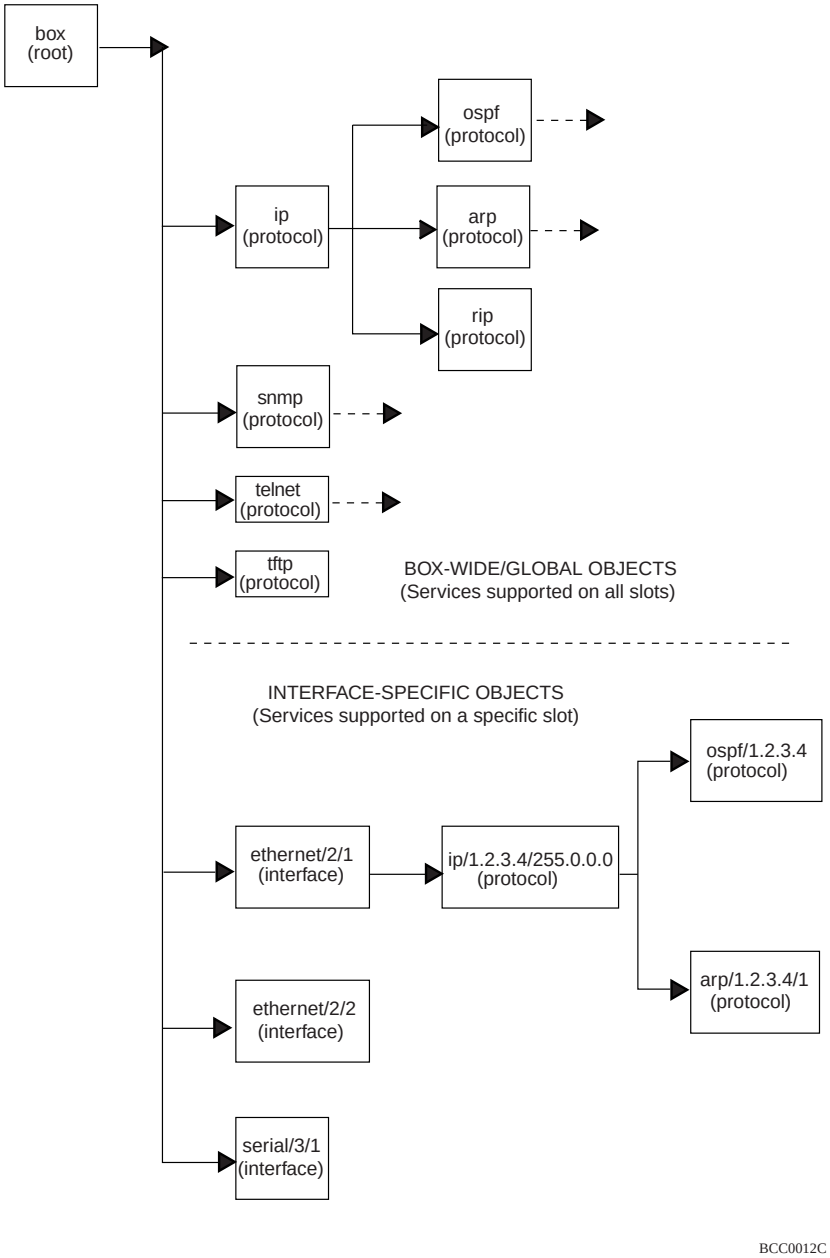


Figure 1-2. Sample BCC Configuration

You use BCC commands to create new objects and to modify or delete objects in an existing configuration hierarchy. You begin at root level in BCC configuration mode and navigate to objects in the device configuration tree.

For example, on a BLN router, you can use BCC commands to add a new physical interface (such as Ethernet) on *box*, add IP to the Ethernet interface, and then add RIP to IP on that interface. Figure 1-3 shows the sequence of commands necessary to build this configuration.

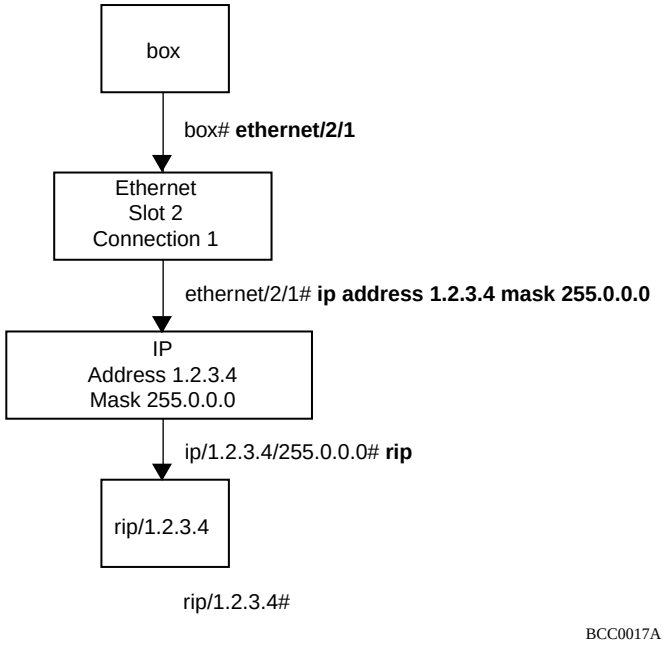


Figure 1-3. Configuring IP and RIP on an Ethernet Interface

Configuration Context

Your working location within the BCC configuration tree is referred to as the *context*. Just as a UNIX file system has a current working directory within which you can add, modify, or delete files, the BCC configuration tree has a current working context, within which you can add, modify, disable, reenable, or delete objects.

The BCC displays the context of an object in terms of its location along a path that begins at the root level of the device configuration tree. Each semicolon in the path marks a transition from one level to the next branch level in the device configuration tree. The semicolon is also equivalent to a Return key entered at the end of a command, effectively starting a new command line.

For example, if you configure an IP interface (address 1.2.3.4, mask 255.0.0.0) on ethernet/2/1 of a BLN router, the BCC displays its location as *box; ethernet/2/1; ip/1.2.3.4/255.0.0.0* (Figure 1-4.).

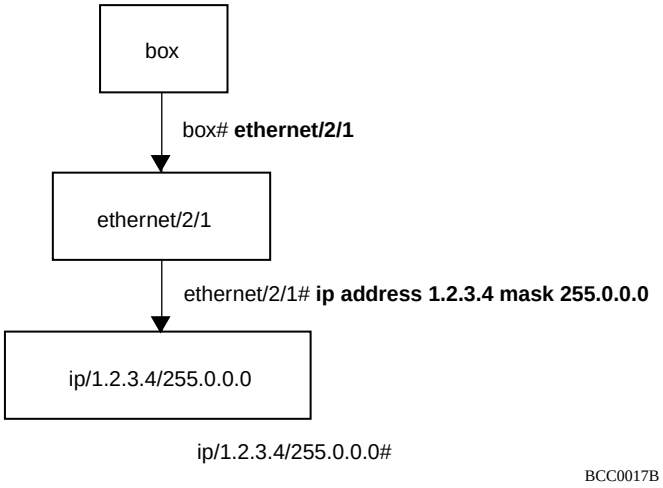


Figure 1-4. Location or Context in Configuration Mode

Objects and Instances

In BCC terminology, configurable entities are referred to as *objects* of a particular *class*, each of which constitutes an *instance:*

- An *object* is a configurable physical or logical entity such as a physical interface or a protocol on an interface. Every configurable object belongs to a specific *class* that defines its characteristics.

- A *class* is a template for a configurable object (such as Ethernet or the protocol IP). When you add a new object to the configuration of a device, the BCC creates a copy (an *instance*) of the appropriate template.
- An *instance* is an object uniquely identifiable within the total device configuration. Each instance is identified by its BCC instance identifier.

BCC Instance Identifier

A BCC instance identifier uniquely identifies a single instance of an object configured on a device. The BCC instance ID consists typically of the name of the object, combined with the values you specify for its required parameters. For example, the BCC instance ID for an Ethernet interface on a BN platform consists of **ethernet/***<slot>/<connector>*, as in **ethernet/2/1**; the BCC instance ID for an Ethernet interface on an ASN platform consists of **ethernet/***<slot>/<module>/<connector>*, as in **ethernet/1/2/2**.

A configurable object may also have required parameters that do not become part of its BCC instance ID. For example, the global OSPF object has a required *router-id* parameter that does not become part of the instance ID.

Each object has its own requirements for unique instance identification within the total device configuration.

Global (Box-Wide) Objects

Global (or *box-wide*) objects provide services uniformly to all slots of a network device. Examples include global IP, BGP, TCP, SNMP, FTP, TFTP, and Telnet. Some protocols, such as IP, RIP, and OSPF, have global and interface-level objects.

Physical Device Objects

The following sections provide BCC terms for the physical device.

Box and Stack

The BCC uses the term *box* or *stack* to identify the root level of the BCC configuration tree for a Nortel Networks device. Every box or stack object has a *type* parameter. The value assigned to the *type* parameter identifies the type of Nortel Networks device chassis:

type **Value**	**Router Model**
an	AN/ANH
arn	ARN
asn	ASN
freln	BLN
frecn	BCN
sys5000	System 5000

Board

The BCC uses the term *board* to identify any logic or circuit board in a Nortel Networks device. Each board typically occupies a *slot* in a network device. On some Nortel Networks products, one board may contain another board such as an RMON data collection module (DCM). All board objects have a *type* parameter that identifies its hardware type. For example, “qenf” is the value of the type parameter for a Quad Ethernet with Hardware Filters board.

Note: For board descriptions based on the literal value of the *type* parameter for any board object, see the *Release Notes*.

Module

The BCC uses the term *module* to identify network media-specific I/O modules (for Ethernet, Token Ring, etc.). Each module has one or more connectors for attachment to a physical network transmission medium.

Slot

The BCC uses the term *slot* to identify the location, as well as a physical and electrical means, for attaching boards to logic and power connections available on the device chassis. Note the following:

- Multislot devices such as the BLN or BCN router accommodate a *system module* (SRM-L) in one slot, and one *link module* in each remaining slot.
- Single-slot devices such as the AN, ANH, ASN, and ARN routers accommodate one *base module* (slot 1), which may be augmented by one or two *adapter modules*, and one *expansion module*.

Connector

The BCC uses the term *connector* to identify the physical and electrical means to interconnect a network device (slot or module) directly or indirectly to a physical network transmission medium.

Line

The BCC uses the term *line* to identify the physical (and in some cases, logical) circuit identified typically by means of a slot, connector, interface type (ethernet, sync, fddi, and so on), and, where applicable, a channel number (such as with T1/E1 interface types).

Port

The BCC uses the term *port* to identify an interface object defined by its type (for example, an Ethernet port) and location (slot and connector) within a network device. On a network device, a port is also a logical point of termination for data sent or received by a specific protocol or application.

Interface

The BCC uses the term *interface* to identify circuitry and digital logic associated with the interconnection between a physical network medium (such as Ethernet) and a higher-layer protocol entity (such as IP).

Note: A *logical interface* is an addressable entity for originating and terminating connections across an IP network.

Parameters

A *parameter* is an attribute (or property) of a configurable object. Parameters can be classified as one of the following:

- Required
- Derived
- Optional

Required

For any BCC object, required parameters are a minimum set of parameters for which the BCC requires you to supply values. For example, the required parameters of a physical port are **slot** and **connector**.

Derived

Derived parameters are parameters for which the BCC supplies a value. For example, a derived parameter of the global OSPF object is **router-id**. In this case, the BCC derives a value for router-id from the address of the first IP interface configured on the device.

Optional

Optional parameters are parameters for which you can specify customized values, replacing any default values set by the system. For example, an optional parameter of an Ethernet interface is **bofl-retries**. This parameter normally has a default value of **5** (5 retries), but you can change this to another numeric value.

Chapter 2
Getting Started with the BCC

This chapter provides information about the following topics:

Topic	Page
Entering and Exiting the BCC Interface	2-1
Displaying Your Location in Configuration Mode	2-3
Navigating in Configuration Mode	2-3
Displaying Configuration Data	2-8
Displaying Help on System Commands	2-26
Displaying Help on show Commands	2-26

Entering and Exiting the BCC Interface

To access the BCC interface on a Nortel Networks router:

1. **Open a Technician Interface session with the target router.**

   For detailed information about opening a Technician Interface session, see *Using Technician Interface Software*.

2. **Enter the Manager, Operator, or User command at the login prompt that appears on your Telnet or console display.**

The Manager login allows you to enter any system command and allows read-write access to the device configuration. The Operator login allows you to enter only operator-level system commands and allows limited access to the device configuration. The User login allows you to enter only user-level system command and allows read-only access to the device configuration. For a list of system commands and the privilege level required to execute them, refer to Appendix B, "System Commands."

3. **Enter bcc at the Technician Interface prompt.**

```
Router1> bcc

Welcome to Bay Command Console!

  * To enter configuration mode, type config

  * To list all system commands, type ?

  * To exit the BCC, type exit
bcc>
```

4. **Enter config at the BCC prompt.**

```
bcc>  config
box#
```

You enter configuration mode at the root (box) level of the BCC configuration tree. The prompt ends with a pound symbol (#) if you have read-write privileges (Manager only), or with a greater than symbol (>) if you have read-only privileges (Manager or User).

If you enter BCC configuration mode as Manager and want to change your privilege level for the current session from read-write to read-only, enter **config -read-only**. To change Manager privileges back to read-write, enter **config -read-write**. You cannot change your privilege level from read-only to read-write if you logged in as User.

Caution: When you enter BCC configuration commands with read-write privileges, you immediately modify the device configuration.

5. **When you finish using BCC configuration mode, enter the exit command at any prompt.**

```
box#  exit
bcc>
```

6. **When you finish using the BCC, enter the exit command at the BCC prompt.**

```
bcc>  exit
Router1>
```

   Exiting the BCC returns you to the Technician Interface prompt.

For more detailed information about Technician Interface access, login, or logout procedures, see *Using Technician Interface Software*.

Displaying Your Location in Configuration Mode

In configuration mode, the BCC displays a context-sensitive prompt. The prompt identifies the configured object at your current working location within the configuration hierarchy. For example, after logging in to a BLN router as Manager, then configuring or navigating to the Ethernet interface on slot 2 connector 1, the BCC displays the following prompt:

```
ethernet/2/1#
```

To display the complete path from root level to your current level in the device configuration tree, enter the **pwc** (print working context) command.

Example:

```
rip/192.168.125.34# pwc
box; ethernet/2/1; ip/192.168.125.34/255.255.255.224; rip/192.168.125.34;
```

The **pwc** command displays the BCC instance identifier of each configured object in the path.

Navigating in Configuration Mode

You can navigate from one object to another in BCC configuration mode by using:

- The **back** command
- Configuration commands

Navigating with the back Command

In BCC configuration mode, use the **back** command to move a specific number of levels back toward root level. The syntax for the **back** command is as follows:

back [*<n>*]

n is the number of levels.

Entering the **back** command with no argument moves you back one level closer to root level.

Example:

```
rip/192.168.125.34# back
ip/192.168.125.34/255.255.255.224# back
ethernet/2/1#
```

Entering the **back** command with an integer moves you from your current working location, back toward root, the number of levels you specify.

Example:

```
rip/192.168.125.34# back 2
ethernet/2/1#
```

In this example, the **back 2** command moves you from the current working location (rip/192.168.125.34), back two levels to ethernet/2/1 (with ip/192.168.125.34/255.255.255.224 as the intervening level).

Note: If you enter an integer value that exceeds the actual number of levels back to root (box or stack) level, the BCC returns to root level.

Navigating with Configuration Commands

Using BCC configuration commands, you can:

- Move back to a previous level.
- Move back to root level.
- Move forward to the next level.
- Move from your current level to any other level in the device configuration tree.

Moving Back One or More Levels

To move from your current working level back one or more levels closer to root level of the device configuration tree, you can enter the full BCC instance ID of the desired object, as follows:

Example (go back one level):

```
rip/192.168.125.34# ip/192.168.125.34/255.255.255.224
ip/192.168.125.34/255.255.255.224#
```

Example (go back two levels):

```
rip/192.168.155.151#  ethernet/2/1
ethernet/2/1#
```

In the second example, the BCC searches back toward root until it finds a context or level where the object you specified (in this case, ethernet/2/1) exists in the router configuration tree. The BCC enters the context of this object, and the prompt displays your new location.

Moving Back to Root Level

You can move back to root level in configuration mode by entering the name of the object at that level.

For an AN, ANH, ARN, or BN router, enter:

```
ip/1.2.3.4#  box
box#
```

For an ASN or System 5000 router, enter:

```
ip/1.2.3.4#  stack
stack#
```

Moving Forward One or More Levels

To move from your current working level to the next configured level (Figure 2-1), enter the BCC instance ID of the desired object, as follows:

Example:

```
box#  ethernet/2/1
ethernet/2/1#  ip/1.2.3.4/255.0.0.0
ip/1.2.3.4/255.0.0.0#  rip
rip/1.2.3.4#
```

Notice that a slash character (/) joins the name and any required parameter values to make a BCC instance ID for any configured object.

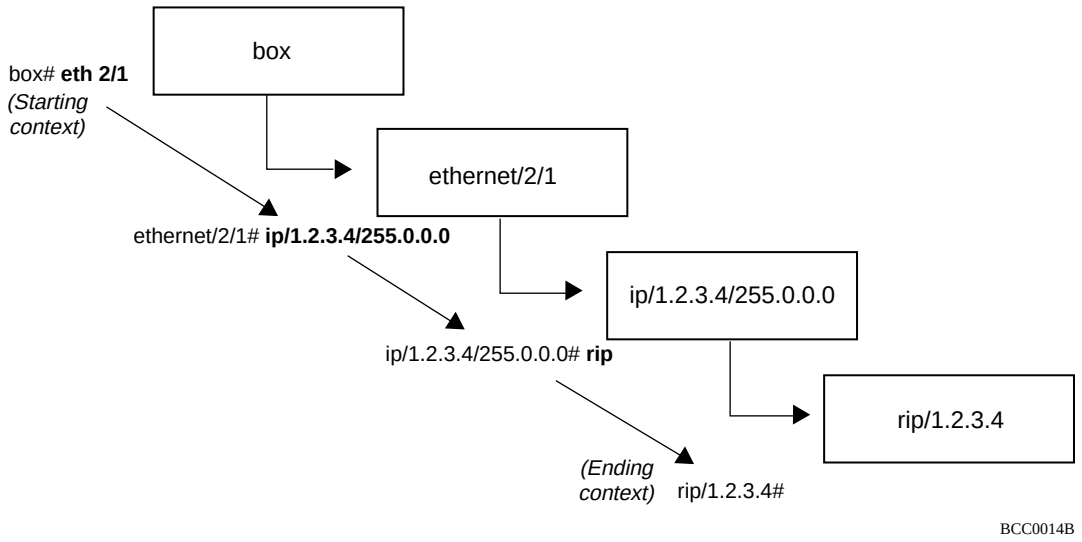


Figure 2-1. Moving Away from Root Level

Moving to Any Context in the Device Configuration

To navigate to any configured object, you can specify a full, or absolute, path from root (box or stack) level at any prompt. When you enter a path, specify the BCC instance identifier of each object.

Example:

To move from ip/192.168.33.66/255.255.255.0 (on ethernet/2/1) to rip/1.2.3.4 on ethernet/2/2 (Figure 2-2), enter the following command:

```
ip/192.168.33.66/255.255.255.0# box;ethernet/2/2;ip/1.2.3.4/255.0.0.0;rip
rip/1.2.3.4#
```

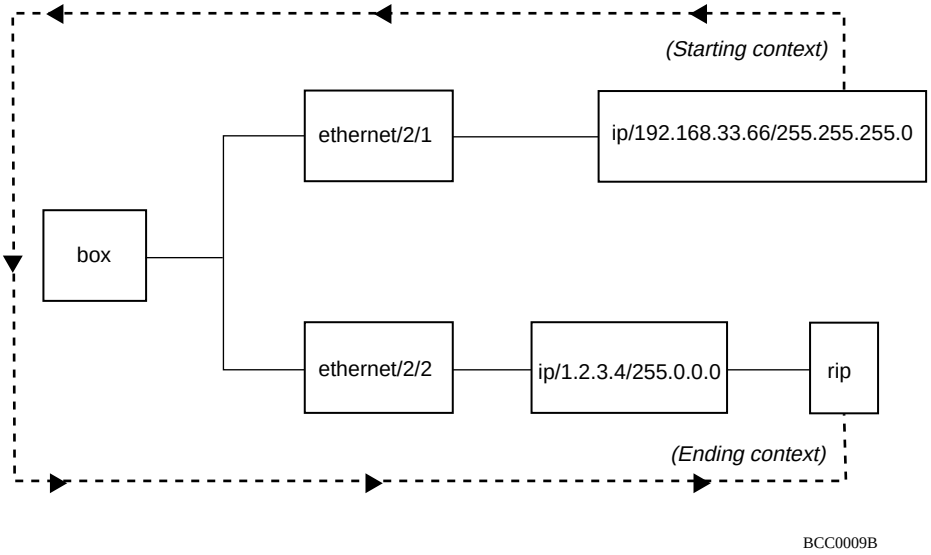


Figure 2-2. Navigating to an Object in the Configuration

The BCC can automatically search backward (recursively) toward root level until it finds a level where the object you specify first in the command line exists in the device configuration tree.

Example:

To move from ip/192.168.33.66/255.255.255.0 on ethernet/2/1 to rip/1.2.3.4 on ethernet/2/2, enter the following command:

```
ip/192.168.33.66/255.255.255.0# ethernet/2/2;ip/1.2.3.4/255.0.0.0;rip
rip/1.2.3.4#
```

In this example, the BCC searches backward to find ethernet/2/2 (specified first in the command line), and then moves sequentially to the other locations (ip/1.2.3.4/255.0.0.0 and rip) specified next in the command line.

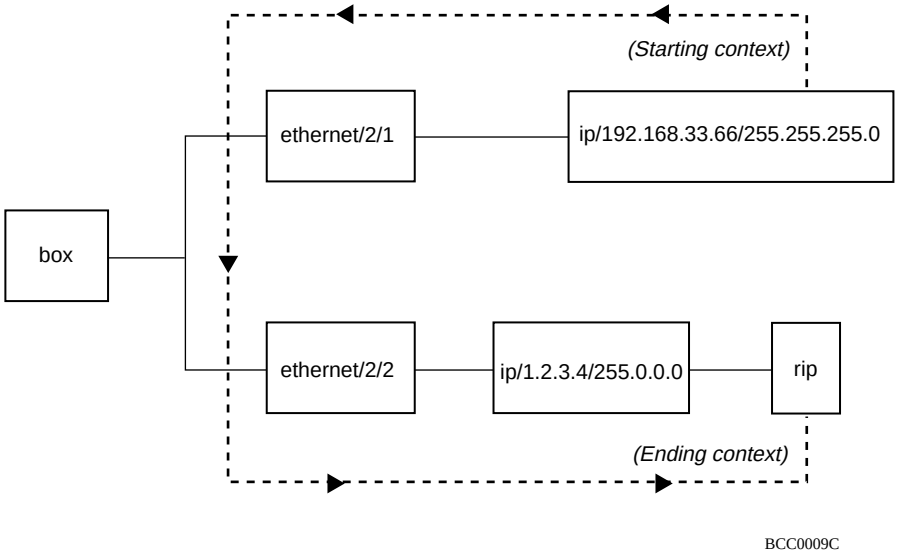


Figure 2-3. Navigating with the BCC Recursive Search Feature

Displaying Configuration Data

There are several BCC help commands that let you:

- Display information on objects in the active (actual) device configuration.
- Display information on objects that you can *add* to the current configuration. These are **?** and **help tree** [**-all**].

Displaying Current/Active Configuration Data

With the **show config** and **lso** commands, you can display:

- The current device configuration
- The operating parameters of each configured object
- The values set for the parameters of each configured object

The optional arguments you add to these commands depend on what you want to see, as follows:

Command	Task
show config **Note**: Combine the following command options to customize **show config** output.	Show the configuration of the current object only. (Entered without any command -*<option>*, **show config** does not display objects configured on the current object.)
<BCC_instance_ID>	Show the configuration of this object (specified by the BCC instance identifier).
-recursive	Show any dependent objects configured on this (current or specified) object. *Examples*: • **show config -recursive** • **show config -compact -recursive** • **show config ip/1.2.3.4/255.0.0.0 -recursive**
-verbose	Show the configuration including the current (default or nondefault) value of every parameter of the object(s) shown. *Examples*: • **show config -verbose** • **show config -recursive -verbose** • **show config ip/1.2.3.4/255.0.0.0 -recursive -verbose**
-all	Show the total device configuration. *Examples*: • **show config -all** • **show config -all -verbose**
-compact	Show the configuration without navigation (**back**) commands. Example: **show config -compact** **Note**: In configuration mode, do not import (using **source**) the contents of a file saved using the **-compact** option.
-file *<filename>*	Save the output of this command to a file. *Examples*: • **show config -file boston.config** • **show config -recursive -verbose -file boston.config**

Note: The **show config** command does not display the values of parameters currently set to their default values unless you use the **-verbose** argument.

Regardless of the command options you enter, output of the **show config** command typically includes:

- Objects added by a user into the active device configuration
- Objects added automatically by the BCC to support a user-configured object

The arguments you add to the **lso** command also depend on what you want to see, as follows:

Command	Task
lso	List only next-level objects configured on the current object. (Display output in tabular format.) Example: **lso**
lso -list	List only next-level objects configured on the current object. (Display output in nontabular format.) Example: **lso -l**
lso -recursive	List, by BCC instance identifier, objects configured at every level on the current object. (Display the path from root level to each configured object.) Example: **lso -r** **Note**: You cannot combine the **-l** and **-r** arguments of the **lso** command.

Displaying Configured Objects

You can display:

- The current object (the object shown in the BCC configuration prompt)
- An object you specify by BCC instance ID
- Objects configured at the next (subcontext) level
- All branches configured on the current object

- The total device configuration tree (active configuration only)
- The IDs of all configured objects
- The active configuration in compact format

Displaying the Current Object

To display the configuration of the current object, minus any dependent objects configured on the same branch, use the **show config** command.

Example:

```
ethernet/2/1# show config
ethernet slot 2 connector 1
    circuit-name E21-alpha
```

Displaying a Specified Object

To display the configuration of any object you specify by BCC instance ID from any configuration context, enter:

show config *<BCC_Instance_ID>*

BCC_instance_ID is the identifier assigned by the BCC to uniquely identify a specific object in the active device configuration.

Example:

Show the configuration of an object with the ID **ip/192.168.125.34/255.255.255.224.**

```
ethernet/2/1#  show config ip/192.168.125.34/255.255.255.224
ip address 192.168.125.34 mask 255.255.255.224
    broadcast 192.168.125.32
```

To display the configuration of all other objects configured on the same branch, add the **-recursive** (or **-r**) option to the **show config** *<BCC_instance_ID>* command.

Example:

```
box# show config ip/192.168.125.34/255.255.255.224 -r
ip address 192.168.125.34 mask 255.255.255.224
    broadcast 192.168.125.32
  arp
  back
  rip
  back
back
```

Displaying Objects at the Next Subcontext Level

To display by BCC instance identifier any objects configured at the next subcontext level accessible from your current location in configuration mode, use the **lso** or **lso -list** (**lso -l**) commands.

Example:

Display in tabular format a list of objects configured on the current object. Show the BCC instance identifier of each configured object.

```
box# lso
board/1         board/4         dns             ip              telnet
board/2         board/5         ethernet/2/1    snmp            tftp
board/3         console/1       ftp             syslog
```

Example:

Display in nontabular format a list of objects configured on the current object. Show the BCC instance identifier of each configured object.

```
box# lso -l
board/1 board/2 board/3 board/4 board/5 ftp snmp tftp console/1
telnet ethernet/2/1 ip dns syslog
```

Displaying Objects at All Subcontext Levels

To display in hierarchical format the active configuration of the current object and any other dependent objects configured on the same branch, use the **show config -recursive** command.

Example:

```
box# eth 2/1
ethernet/2/1# show config -r
ethernet slot 2 connector 1
    circuit-name E21-alpha
  ip address 192.168.125.34 mask 255.255.255.224
      broadcast 192.168.125.32
    arp
    back
    rip
    back
  back
back
```

Output of the **show config -r** command includes any **back** commands necessary for navigation back from the current context to the prior context.

Note: If you enter **show config -r** at root level in configuration mode, the BCC displays the same output as **show config -all**.

Displaying the Total Device Configuration

To display the hierarchical listing of every object actively configured on this device, use the **show config -all** command.

Example:

```
box# show config -all
box
    type frecn
    build-version {BayRS ## BCC ##}
  board slot 5
      type sync
  back
  board slot 7
      type srml
  back
  board slot 9
      type dtok
        .     .     .
        .     .     .
        .     .     .

   console portnum 1
```

```
    prompt {"%slot%:"}
    auto-manager-script automgr.bat
    auto-user-script autouser.bat
  back
  ethernet slot 13 connector 1
    circuit-name E131
   ip address 192.168.133.114 mask 255.255.255.224
    arp
    back
    rip
    back
   back
  back
       .     .     .
       .     .     .
       .     .     .
```

Note: The BCC displays the same output as **show config -all** when you enter **show config -recursive** at root level in configuration mode.

Displaying the Path to Every Configured Object

To display by BCC instance identifier the path to every object configured at the next subcontext levels, enter the **lso -recursive** (**lso -r**) command from your current context.

Note that **lso -r** intially lists all objects configured at the next subcontext level, and then displays the detailed path to each of those objects in standard BCC configuration syntax.

Example (from root level, BLN router):

```
box# lso -r
board/1         board/4         dns             ip              telnet
board/2         board/5         ethernet/2/1    snmp            tftp
board/3         console/1       ftp             syslog

box; board/1;
box; board/2;
       .     .     .
       .     .     .
box; snmp;
community/public
```

```
box; snmp; community/public;
manager/public/0.0.0.0          manager/public/192.32.241.36

box; snmp; community/public; manager/public/0.0.0.0;
box; snmp; community/public; manager/public/192.32.241.36;
       .     .     .
       .     .     .
       .     .     .
```

Example (from an IP interface on ethernet/2/1):

```
ip/192.168.125.34/255.255.255.224# lso -r
arp/192.168.125.34/1    rip/192.168.125.34

box; ethernet/2/1; ip/192.168.125.34/255.255.255.224; arp/192.168.125.34/1;

box; ethernet/2/1; ip/192.168.125.34/255.255.255.224; rip/192.168.125.34;
```

Displaying Configured Objects in Compact Format

To display in compact format the active configuration of the current object or any object you specify by BCC instance ID, use the **show config -compact** command. Command output excludes any **back** commands otherwise shown for navigation from the current context to the prior context.

Example:

Display the configuration of your current context, ethernet/2/1, in compact format.

```
ethernet/2/1# show config -compact
ethernet slot 2 connector 1
    circuit-name E21-alpha
```

Or from any context, supply the BCC instance ID:

```
box# show config -compact ethernet/2/1
ethernet slot 2 connector 1
    circuit-name E21-alpha
```

To display the entire device configuration in compact format, add the **-all** option:

```
box# show config -all -compact
box
    type freln
    build-version {BayRS 13.10 BCC 4.10}
    contact { }
    system-name { lab }
    location Billerica
    help-file-name bcc.help
```

```
board slot 1
    type srml
board slot 2
    type qenf
board slot 3
    type wffddi2m
board slot 5
    type dtok
ftp
    default-volume 2
snmp
    lock-address 255.255.255.255
  community label public
    .     .     .
    .     .     .
    .     .     .
```

Displaying Configured Parameter Values

You can display values configured for any specific parameter, or all parameters, of:

- The current object
- An object configured at the next subcontext level
- An object you specify by BCC instance identifier
- Objects configured at all subcontext levels beyond your current location or ID-specified location in the active device configuration.

Displaying the Value of One Parameter

To display the value assigned to a specific parameter of the current object or an object configured at the next (subcontext) level, just enter the parameter name:

```
ethernet/2/1# bofl-timeout
  bofl-timeout 5
```

The BCC returns the name and value assigned to the parameter you specified.

You can also use the **info** command to obtain essentially the same information in a more terse format:

```
ethernet/2/1# info bofl-timeout
5
```

To display the most detailed information on values for the same parameter, use the **?** command:

```
ethernet/2/1# bofl-timeout ?
Current Value: 5
Legal Values:  <unsigned integer>
Default Value: 5
```

To display the value assigned to any parameter of an object configured at the next subcontext level, first obtain a list objects configured at the next subcontext level:

```
ethernet/2/1# lso
ip/192.168.125.34/255.255.255.224
```

Next, copy and paste into the current command line the BCC instance identifier of the desired object, followed by the name of the parameter you want to check for current value, as follows:

```
ethernet/2/1# ip/192.168.125.34/255.255.255.224 address-resolution
  address-resolution arp
```

For the most detailed information on the same parameter, use the **?** command:

```
ethernet/2/1# ip/192.168.125.34/255.255.255.224 address-resolution ?
Current Value: arp
Legal Values:
arp,ddn,pdn,in-arp,arp-in-arp,none,bfe-ddn,probe,arp-probe,atm-arp
Default Value: arp
```

Displaying All Parameter Values of an Object

To display parameter settings for the current object, use the **info** or **show config -verbose** commands.

Example (using the **info** *command):*

```
ethernet/2/1# info
  slot 2
  circuit-name E21-alpha
  state enabled
  connector 1
  bofl enable
  bofl-timeout 5
  hardware-filter disable
  transmit-queue-length 0
  receive-queue-length 0
  bofl-retries 5
  bofl-tmo-divisor 1
```

Example (using the* show config -verbose *command):

```
ethernet/2/1# show config -v
ethernet slot 2 connector 1
    circuit-name E21-alpha
    state enabled
    bofl enable
    bofl-timeout 5
    hardware-filter disable
    transmit-queue-length 0
    receive-queue-length 0
    bofl-retries 5
    bofl-tmo-divisor 1
```

From any configuration context, use the following command to display all parameter values associated with an object anywhere in the active device configuration:

show config *<BCC_instance_ID>* **-verbose**

Example:

```
box# show config ip/192.168.125.34/255.255.255.224 -v
ip address 192.168.125.34 mask 255.255.255.224
    state enabled
    assocaddr 0.0.0.0
    cost 1
    broadcast 192.168.125.32
    configured-mac-address 0x
    mtu-discovery disabled
    mask-reply disabled
    all-subnet-broadcast disabled
    address-resolution arp
    proxy disabled
    host-cache-aging cache-off
    udp-checksum enabled
    end-station-support disabled
    redirects enabled
    cache-size 128
```

Displaying Parameter Values for All Objects on a Branch

To display the parameter values assigned to all objects accessible from your current context, or from a context you specify by BCC instance identifier, use the following command:

show config [*<BCC_instance_ID>*] **-recursive -verbose**

or:

show config [*<BCC_instance_ID>*] **-r -v**

Example:

Display parameters of an object configured at the next subcontext level, relative to your current location in the device configuration tree.

```
box# eth 2/1 (first navigate to the object)
ethernet/2/1# show config -r -v
ethernet slot 2 connector 1
    circuit-name E21-alpha
    state enabled
    bofl enable
    bofl-timeout 5
    hardware-filter disable
    transmit-queue-length 0
    receive-queue-length 0
    bofl-retries 5
    bofl-tmo-divisor 1
  ip address 192.168.125.34 mask 255.255.255.224
      state enabled
      assocaddr 0.0.0.0
     cost 1
      broadcast 192.168.125.32
        .     .     .
        .     .     .
        .     .     .
        .     .     .
    back
    rip
        state enabled
        supply enabled
        listen enabled
       .     .     .
       .     .     .
       .     .     .
    back
  back
back
```

Example:

Display parameters associated with all objects configured on ip/192.168.125.34/255.255.255.224:

```
box# show config ip/192.168.125.34/255.255.255.224 -r -v
ip address 192.168.125.34 mask 255.255.255.224
    state enabled
    assocaddr 0.0.0.0
    cost 1
       .     .     .
       .     .     .
  arp
      state enabled
  back
  rip
      state enabled
      supply enabled
       .     .     .
       .     .     .
       .     .     .
  back
back
```

Displaying Configuration Choices

From your current location in BCC configuration mode, you can display the following information on objects, parameters, and parameter values available for you to configure on a Nortel Networks device.

Command	Task
?	Display objects (subcontexts) available for you to configure on the current object.
	Display the names of parameters of the current object.
<parameter_name> **?** or: *<adjacent_object_name> <parameter_name>* **?**	Display the current, legal, and default values for any parameter of the current object, or for any parameter of an object at the next (adjacent) subcontext level in the device configuration tree.
help tree	Display the objects available at every level on the current branch, starting from your current location.
help tree -all	Display the entire tree of objects available for you to configure on this device.

Displaying the Total Device Configuration Tree (All Available Choices)

To display, from any BCC prompt, every object you can choose to add to the current device configuration, use the **help tree -all** command.

Example (BCN router):

```
box# help tree -all
The entire configuration tree is:
  board
  virtual
    ip
      ospf
        neighbor
  ftp
  http
  ntp
    peer
  snmp
    community
      manager
    trap-entity
    trap-event
  tftp
  console
  telnet
    client
    server
  atm
    atm-interface
    signaling
      timers
      signaling-vc
      ilmi
        ilmi-vc
      sscop
        .     .     .
        .     .     .
        .     .     .
```

Displaying Choices Available from the Current Context

To list the names of all objects and parameters you can access from the current context in configuration mode, enter the **?** command.

Example:

```
ip/192.168.125.34/255.255.255.224# ?
Sub-Contexts:
  arp     igmp    ospf    rdisc   rip

Parameters in Current Context:
  address                 cost                    on
  address-resolution      end-station-support     proxy
  all-subnet-broadcast    has                     redirects
  assocaddr               host-cache-aging        state
  broadcast               mask                    udp-checksum
  cache-size              mask-reply
  configured-mac-address  mtu-discovery
```

The subcontexts section lists the objects that you can add from your current location in the device configuration tree (Figure 2-4).

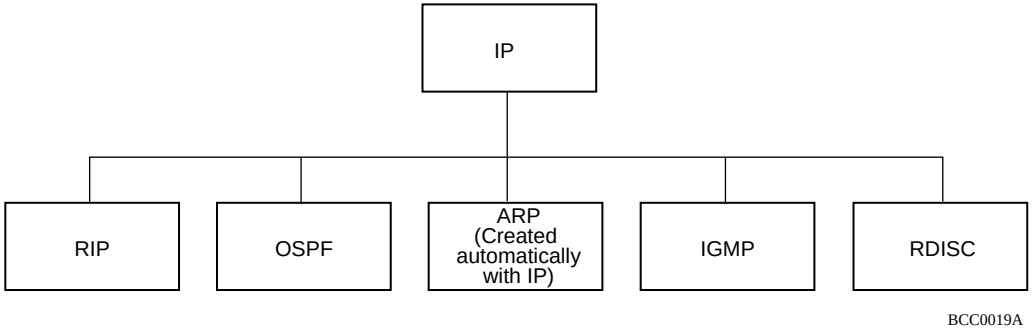


Figure 2-4. Objects You Can Configure at the Next (Subcontext) Level

Displaying Choices Available at All Subcontext Levels

To list the objects you can access and add to the device configuration from your current location in BCC configuration mode, enter the **help tree** command. This is an easy way to see the navigational path you must follow to configure an object several levels away from your current location.

Example:

```
ethernet/2/1# help tree
The configuration tree below this context is:
  ip
    arp
    rip
    ospf
      neighbor
    rdisc
    igmp
      relay
  ipx
    rip
    sap
    static-route
    adjacent-host
    static-service
    route-filter
    server-network-filter
    server-name-filter
  auto-neg
```

Entering the **help tree** command at root level (box or stack) is the same as entering the **help tree -all** command from any configuration context.

Displaying Parameter Definitions

To display configuration syntax (usage) help and parameter definitions for any object within the device configuration tree, enter:

help <*object_name*>

object_name is the BCC designation for any object (interface, protocol, or other configurable item) that you can configure using the BCC interface.

Example:

```
ethernet/2/1# help ethernet
Usage: "ethernet slot <value> connector <value>"
Or:    "ethernet <slot>/<connector>"

                              ethernet Parameters:

_____________________________________________________________________________

   state
         Indicates the administrative state of this object (enabled
or disabled).

   bofl
          Allows breath-of-life polls to be disabled.

   bofl-retries
          Specifies the BOFL Retry Count.

      .            .           .
      .            .           .
      .            .           .
```

If the *object_name* is unique among all object names in the BCC configuration tree, the BCC displays the parameter definitions you requested. If the *object_name* is not unique among all object names (the same name exists in multiple locations in the BCC configuration tree), the BCC returns a list of the all **help** commands that lead to an object that contains the *object_name* you specified.

For example, you may want to see the definitions for all parameters of “ip,” but IP has a global component and can exist in any interface context, as well. The name “ip” also exists in “ipx,” which causes the BCC to list the help commands for every ip and ipx object.

This happens when you enter **help ip**:

```
ethernet/13/1# help ip
"help ip" is ambiguous.  Copy and re-enter one of the following
commands:
help atm classical-ip-service ip
help atm lec-service ip
help atm lec-service ipx
help atm pvc-service ip
help atm pvc-service ipx
help box ip
help box ipx
help demand-pool demand-circuit frame-relay default-service ip
help demand-pool demand-circuit frame-relay default-service ipx
      .           .          .
      .           .          .
      .           .          .
help serial ppp ipx
help serial ppp ipxwan
help serial standard ip
help serial standard ipx
help token-ring ip
help token-ring ipx
help virtual ip
```

Note that the response starts with “Copy and re-enter one of the following commands.” For example, if you copy and re-enter the explicit command **help ethernet ip**, the BCC immediately displays usage help and parameter definitions for that particular “ip”:

```
ethernet/13/1# help ethernet ip
Usage: "ip address <value> mask <value>"
Or:    "ip <address>/<mask>"

                                ip Parameters:
   ____________________________________________________________________

   state
          Indicates the administrative state of this object (enabled or
          disabled).

   address
          -REQUIRED- Specifies the IP address of this interface.

   address-resolution
          Specifies the address resolution type.
      .        .        .
      .        .        .
      .        .        .
```

If you want to display the definition for a *specific parameter of the current object only,* enter **help** *<parameter_name>*. (By default, the BCC displays the entire list of parameter definitions for the current object.)

Saving Displayed Configuration Data

For more information on using the **show config -file** command to save configuration data to a file, refer to "Saving Configuration Commands to a File on a Nortel Networks Device" on page 3-14.

Displaying Help on System Commands

Table 2-1 lists the commands that explain how to use BCC system commands.

Table 2-1. Help for BCC System Commands

Command	Help Feature
help	Get an overview of Help-oriented command features.
help *<command>*	Get full details on a specific command.
help commands	Display the syntax of all BCC commands in alphabetical order.
help commands -more	Display the syntax and brief command descriptions for all BCC commands in alphabetical order.
help editing	Get Help on how to edit BCC commands and command lines.
help learning-bcc	Get Help on performing common BCC operations. This command provides a microtutorial on how to use the BCC interface.
help syntax	Get Help on how to interpret symbols used to describe BCC command syntax.

Displaying Help on show Commands

BCC **show** commands use the following syntax:

show *<object_name> <keyword>*...[*<keyword>*] -[*<filter>*[*<filter_argument>*]]...-[*<filter>*[*<filter_argument>*]]

object_name is the name of a configured object, such as **ip**, **ethernet**, or **dns**. The only exception to this rule is **show config**, described in "Displaying Configuration Data" on page 2-8.

keyword is a subcommand that further specifies what aspect of *object_name* you want to see, such as **show ip routes**. Many **show** commands have multiple keyword levels, such as **show frame-relay stats lapf errors**.

-*filter* is a command option that limits **show** command output to a specific subset or filtered view of the total information available. You must enter the dash character (-) and the *filter* explicitly, with no space between the two, for example, **show frame-relay stats lapf errors -interface**. You can often combine filters in a single command, such as: **show atm interfaces -disabled -slot 9**

filter_argument pertains to the *filter* preceding it in the command line. The *filter_argument* further restricts the filtered output from a **show** command, such as: **show frame-relay stats lapf errors -interface** *<interface_address>*.

To display any available **show** command *object_name*, *keyword*, *filter*, or *filter_argument*, use the **?** command, as follows:

- To display a list of every *object_name* available for the BCC **show** command, enter **show ?**.

Example:

```
bcc> show ?
  access          dsucsu          hifn            mct1e1          sonet
  atm             dsx3            hssi            modem           syslog
  bgp             dvmrp           http            mtm             system
  bri             ethernet        hwcomp          ntp             tcp
  classical-ip    fddi            igmp            ospf            telnet
  config          frame-relay     ip              ppp             tftp
  console         ft1e1           ipx             process         token-ring
  dial            ftp             isdn-switch     serial          wcp
  dns             hardware        lane            snmp
```

- To display every *keyword* available for a specific *object_name*, enter **show** *<object_name>* **?**

Example:

```
bcc> show frame-relay ?
  congestion      services        stats           svcs
  multiline       shaping         summary         vcs
```

For show commands that have additional keyword levels:

```
bcc> show ip stats ?
  cache           fragments       security
  datagrams       interface       summary
```

- To display every **-***filter* and *filter_argument* available for a specific **show** command, insert the **?** where filters and their arguments would appear after any keywords in the command line.

Example:

```
bcc> show frame-relay congestion ?
show frame-relay congestion [-state <arg>][-interface <arg>][-service
<arg>] [-dlci <arg>]
```

Usage Notes:

- Use the **show** command to display routing, configuration, interface, and statistical data from the Management Information Base (MIB). The type and amount of data displayed depends on the specific protocol, network service, and/or filtered view you want to see.
- Use lowercase for all show commands.
- *pattern* means that you can use wildcard searching with the ***** and **?** characters. Use ***** to find a string of any characters of any length. Use **?** to designate any character in a specific position of the search string. For example, to locate all networks whose addresses begin with 29, enter:

  string 29*

  This pattern will locate the addresses 2901456 and 2967. Or if you have a set of names that begin and end with the same characters but have different characters in the middle, such as *xxx*1.*yy*, *xxx*2.*yy* and so on, you can enter the search pattern *xxx***?.***yy* to locate them.

Chapter 3
Entering Commands and Using Command Files

This chapter provides information about the following topics:

Topic	Page
Entering Commands	3-1
System Commands	3-5
Configuration Command Syntax	3-5
Creating and Using BCC Files	3-12

Entering Commands

This section contains information about:

- Using Command Abbreviations
- Recalling Commands
- Editing Command Lines
- Entering Multiple Commands on a Line
- Continuing a Command Line

Using Command Abbreviations

When you enter BCC commands in configuration mode, you can shorten object and parameter names (for example, *eth* = *ethernet*). You must enter a sufficient number of characters for the BCC to recognize that name uniquely.

Example:

```
box#  eth 5/1
ethernet/5/1#  back
box#  tf
tftp#
```

You can abbreviate system commands; for example, the BCC recognizes **sh** as **show** in contexts where there are no other commands, configurable objects, or parameter names that also start with **sh**.

Recalling Commands

The BCC supports a configurable command history buffer, from which you can recall commands recently entered. The command history buffer contains up to 20 commands by default. You can increase the number of commands in the history buffer to a maximum of 40 by setting new values for the history parameter of the console and telnet objects.

Example:

```
box# telnet
telnet# server
server# history 30
server# history
   history 30
server# box
box# console portnum 1
console/1# history 30
console/1#
```

Recall commands from the history buffer as follows:

- To recall the previous command, press the up arrow key, or press [Control]+p.
- To recall the next command, press the down arrow key, or press [Control]+n.

Editing Command Lines

Table 3-1 describes the keystrokes you can use to edit BCC command lines.

Table 3-1. Keystrokes for Editing BCC Command Lines

Editing Function	Keystrokes
Move the cursor left	CONTROL + b or left arrow key
Move the cursor right	CONTROL + f or right arrow key
Delete the current line	CONTROL + u
Delete the word at the cursor location	CONTROL + w
Delete the character at the cursor location	CONTROL + d
Move the cursor to the beginning of the line	CONTROL + a
Move the cursor to the end of the line	CONTROL + e
Toggle insert mode	CONTROL + o
Delete previous character	BKSP or DEL, or CONTROL + h
Interrupt	CONTROL + c
Start echo to the screen	CONTROL + q
Stop echo to the screen	CONTROL + s
Recall previous command	CONTROL + p or up arrow key
Recall next command	CONTROL + n or down arrow key

For example, use the up arrow key (or [Control] + p) to retrieve your last input, then use other control-key combinations to edit the command line as needed.

Entering Multiple Commands on a Line

To enter multiple commands on the same line, type a semicolon (;) wherever you would press [Return] to terminate a command.

Example:

Configure ethernet/2/1 from root, then configure ip/1.2.3.4/255.0.0.0 on ethernet/2/1 and RIP on ip/1.2.3.4/255.0.0.0, as follows:

```
box#  ethernet/2/1;ip 1.2.3.4/255.0.0.0;rip
rip/1.2.3.4#
```

Continuing a Command Line

You can continue a command line by entering a backslash (\ ) character at the end of the current text line. The BCC treats characters on the next physical line as part of the same BCC logical command line.

You must immediately follow the backslash (\ ) with a newline (Return) character. The BCC treats these two characters and any trailing spaces as if they were exactly one space. Until you press [Return] without a preceding backslash (\ ) character, the BCC replaces the pound symbol (#) in the context-sensitive prompt with an underscore (_) character.

Example:

```
ip/1.2.3.4/255.0.0.0# cost 2 \
ip/1.2.3.4/255.0.0.0_ mask-reply on \
ip/1.2.3.4/255.0.0.0_ proxy on \
ip/1.2.3.4/255.0.0.0_ aging cache-on
ip/1.2.3.4/255.0.0.0#
```

Some command symbols normally used in pairs to denote the beginning and the end of a set of data also produce the continuation (underscore) prompt, including braces ({ }), brackets ([ ]), and quotation marks (“ ”).

Example:

```
box#  { ...
box_  ...}
box#
```

Note: If you inadvertently type one of the opening symbols and see an underscore (_) prompt, just type the corresponding closing symbol to restore the normal (#) prompt in BCC configuration mode.

System Commands

The BCC supports all system commands described in Appendix B. For help on a specific command, enter:

help *<command>*

Example:

help pwc

Configuration Command Syntax

This section describes BCC configuration commands and the syntax requirements for those commands. This section also describes how to enter BCC configuration commands using the following formats:

- Basic (full) syntax
- Default syntax
- Abbreviated syntax

Caution: Configuration commands make real-time changes to the device configuration.

Command Syntax Requirements

BCC syntax consists of object names, parameter names and values, and various types of punctuation:

- All object and parameter names appear as one word (hyphenated where necessary) in the BCC command line.
- Parameters have either a single value or multiple values enclosed in braces {x y z} in the command line. You can accept the default value or supply a value for each parameter associated with a configurable object.
- Parameters and their values must appear as a pair in the same command line.
- Syntax for specifying the object you want to configure may vary according to the Nortel Networks device to which you are connected. Appendix E, "Syntax for Module Location," lists the BCC syntax for specifying the physical location of a module in each Nortel Networks device.
- If you enter the name of an object without values for its required parameters, or with values inappropriate for its required parameters, the BCC returns usage help, as shown in the following example:

```
box# ethernet
Required parameter "slot" was not specified for ethernet.
Usage: "ethernet slot <value> connector <value>"
Or:    "ethernet <slot>/<connector>
```

Using Basic (Full) Syntax

The basic, or full, syntax for BCC commands consists of the following required and optional elements:

{*<object_name>*} {*<required_parameter>* *<value>* ...} ...
<parameter> *<value>* ... *<parameter>* *<value>*

The BCC requires input for any elements enclosed by braces ({ }).

object_name is the name of an object you want to configure (for example, **ip**).

The BCC assumes that an object you specify is new (and will create it) if it is not in the current configuration. If an object you specify already exists in the current configuration, the BCC assumes that you want to modify that object.

required_parameter and *value* are required to add a new object, or to navigate to an existing object, in the device configuration. Any object may have one or more required parameters.

For example, to add an Ethernet interface to an AN/ANH, ARN, or BN router, enter at root (box#) level:

ethernet slot *<slot_no.>* **connector** *<connector_no.>*

To add an Ethernet interface to an ASN or System 5000 router, enter:

ethernet slot *<slot_no.>* **module** *<module_no.>* **connector** *<connector_no.>*

Note: You cannot change the value of a parameter used by the BCC to create an instance identifier. For example, you cannot modify the address value assigned to an IP interface.To change the value of any required parameter, you must delete the associated object, and then add it back into the device configuration with new required values.

To navigate to an existing (previously configured) Ethernet interface, enter:

ethernet/*<slot>/<connector> (AN/ANH, ARN, BN)*

ethernet/*<slot>/<module>/<connector> (ASN, System 5000)*

parameter and *value* is the format for customizing the value of any parameter of the current object, or of an object you are adding to the device configuration. For more information on how to specify parameter values, see "Specifying Parameter Values" on page 3-9.

Using Default Syntax

Using default syntax, you do not need to enter the name of a required parameter; you enter only its value at the proper location in the command line.

For example, the default syntax for configuring an Ethernet interface on an AN/ANH, ARN, or BN router is:

ethernet *<slot>/<connector>*

The following commands are equivalent.

Using full syntax:

```
box#  ethernet slot 2 connector 1
ethernet/2/1#
```

Using default syntax:

```
box#  ethernet 2/1
ethernet/2/1#
```

Using Abbreviated Syntax

You can abbreviate BCC configuration commands as follows:

Example:

```
box# eth 2/1
```

This command is the same as the following two commands:

```
box# ethernet slot 2 connector 1
box# ethernet 2/1
```

If you press [Return] before entering a sufficient number of characters for the BCC to recognize the name of the object or parameter you want to configure, the BCC returns an error message.

Example:

```
box# e
ambiguous command name "e": enable eof error ethernet eval exit
expr
```

The BCC returns a list of all the commands available in the current context that start with the letter *e*. Choose one command from the list, and enter enough characters for the BCC to recognize that command when you press [Return].

You cannot abbreviate BCC instance identifiers.

Specifying Parameter Values

You must specify each parameter value in the form of a parameter-value pair. Each pair is a command argument pertaining to the object named first in the command line.

For example, the following command changes the Breath of Life (BofL) timeout interval to 4 seconds on ethernet/1/1:

```
box#  ethernet/1/1 bofl-timeout 4
```

bofl-timeout 4 is the parameter-value pair.

Required, Derived, and Other Parameters

The BCC indicates when parameter values are required (you must supply a value) or derived (the BCC supplies a value). For all other parameters, the BCC supplies a default value that you can change.

Specifying Multiple Parameter-Value Pairs

You can specify parameter values as follows:

- Enter an object name and one parameter-value pair per command line.
- Enter an object name and multiple parameter-value pairs (each pair separated by a space) on the same command line.

Example:

In the following example, you specify one parameter-value pair on each command line.

```
box#  ethernet 2/1
ethernet 2/1#  bofl-retries 6
ethernet 2/1#  bofl-timeout 7
ethernet 2/1#  hardware-filter enabled
ethernet 2/1#
```

Example:

In the following example, you specify multiple parameter-value pairs on each command line.

```
ethernet 2/1#  ip address 1.2.3.4 mask 255.255.255.0 redirects off
ip.1.2.3.4/255.255.255.0#  ospf area 2.3.4.54 hello-interval 5
ospf/1.2.3.4#
```

Specifying Multiple Values for One Parameter

Some BCC configuration parameters accept multiple values simultaneously. For example, the Syslog service has a *severity-mask* parameter that accepts any of the values -- **fault**, **warning**, **info**, **trace**, and **debug** -- as follows:

severity-mask {fault warning info trace debug}

or

severity-mask “fault warning info trace debug”

Notice that you must enter these values within braces or quotes, and with a space character after each value except the last. The BCC uses the space character as a delimiter separating each of the values.

Parameters of this data type also typically accept the values **none** or **all** but you can enter these without braces, for example:

severity-mask all
severity-mask none

Parameter Range Validation

For any parameter that takes a numeric value (integer) within a range of values, the BCC automatically checks to see if the value you entered exists within the legal range.

For example, if you look at the legal range for the **mtu** parameter of a classical-ip-service configured on an ATM interface, you see:

```
classical-ip-service/dallas# mtu ?
Current value: 4608
Legal values: Range(0-9188)
Default value: 4608
```

If you try to enter a value outside of the legal value range for the **mtu** parameter, the BCC displays an error message to notify you of the problem:

```
classical-ip-service/dallas# mtu 12000
For data type 'int':
Bad input value: value '12000' out of range
Legal values: RANGE(0-9188)
```

Specifying Name or String Values

Many BCC configuration parameters accept an alphanumeric string value. Typically, these are name parameters with values that do not include space characters.

Examples:

polname abc123
polname abc-123
polname ABC-123

To enter an alphanumeric string that includes spaces, enclose the entire value within braces or quotes, for example:

polname {Abc 123}

or

polname "Abc 123"

For parameters of this data type, the BCC treats any space characters between the braces as part of the alphanumeric string.

Disabling, Reenabling, and Deleting a Configured Object

Use the commands in Table 3-2 to disable, reenable, and delete any object in the current configuration context, or the immediate/adjacent subcontext.

Table 3-2. BCC Commands for Disabling, Reenabling, and Deleting

Enter:	To Perform the Following Function:
disable	Change the state of a configured object to disabled: `ip/1.2.3.4/255.0.0.0#` **disable** You can alternatively assign the value “disabled” to the state parameter : `ip/1.2.3.4/255.0.0.0#` **state disabled**
enable	Change the state of a configured object to enabled: `ip/1.2.3.4/255.0.0.0#` **enable** You can alternatively assign the value “enabled” to the state parameter: `ip/1.2.3.4/255.0.0.0#` **state enabled**
delete	Delete the object identified in the BCC context-sensitive prompt. Example: `ip/1.2.3.4/255.0.0.0#` **delete** **Caution:** Deleting an object at one level of the configuration tree deletes all of its dependent objects (branches stemming from that location).

To disable, reenable, or delete an object in the immediate subcontext, relative to your current location in the device configuration, enter one of the following commands:

disable *<BCC_instance_id>*

enable *<BCC_instance_id>*

delete *<BCC_instance_id>*

Examples:

`ethernet/2/1#` **disable ip/1.2.3.4/255.0.0.0**

`ethernet/2/1#` **enable ip/1.2.3.4/255.0.0.0**

`ip/1.2.3.4/255.0.0.0#` **delete rip/1.2.3.4**

Creating and Using BCC Files

You can save BCC configuration commands to an ASCII file, edit the file, add comments, and then use the **source** command in configuration mode to read the file (merge the new configuration data) into the device’s active configuration.

You can also save TCL scripting commands to a file, use the **source** command to read the file into device memory, and then run the script by entering an associated command name. For information on TCL scripting commands supported by the BCC interface, see Appendix C, "TCL Support."

Saving Commands and Displays to a File on a Workstation

If you log in to a Nortel Networks router from a PC or workstation using Telnet or terminal emulation, you can use the native capabilities of the PC or workstation to:

- Save the output of any **show config** command to an ASCII file.
- Save the output of any **help tree** command for later reference or printing.
- Save a sequence of manually entered BCC commands to an ASCII file.
- Save log displays to an ASCII file for later analysis.

You can also use an ASCII text editor on a PC or workstation to create a file containing BCC commands, offline. You can later download the same file to a Nortel Networks device, and then use the BCC **source** command to import the contents of that file into the active device configuration.

Note: You can also save the output of the **show config** command to an ASCII text file on the router by entering:

show config -all -file *<volume>:<filename>*

Saving Configuration Commands to a File on a Nortel Networks Device

You can save the output of any **show config** command to a file on a Nortel Networks device. Output you save to a file using the **show config -file** command does not also appear on the console device.

You can later use the BCC **source** command to import (merge) configuration data from a file into the active device configuration.

You cannot import commands saved to a file from output of any **show config** command containing the **-compact** option. (The **-compact** option eliminates **back** commands necessary for navigation in BCC configuration mode.)

Examples:

show config -file

show config -all -file

show config -verbose -file

show config -recursive -file

show config -compact -file

show config -all -verbose -file

show config -all -verbose -compact -file

Adding Comments to a Command File

You can use a text editor (such as *vi* on a UNIX workstation) to add descriptive comments to a BCC command file. Enter comments in the following format:

<command> **;#** *<comment>*

or

#<comment>
<command>

Example:

box# **board slot 1 type ansed;# 192.168.47.129 192.168.47.21**

When you finish editing the file, save it on your workstation or PC. The comments are for reference only. Comments do not appear in the output of any **show config** command.

Importing Configuration Commands from a File

When you are logged in to the BCC as Manager, you can use the **source** command in configuration mode to read BCC configuration and navigation commands from a designated ASCII source file into the active device configuration.

Caution: The **source** command makes immediate changes to the active device configuration.

The **source** command *merges* new configuration data from a file with existing data in device memory. If the file you specify contains configuration commands pertaining to objects already defined on the device, those commands overwrite the current configuration.

Note: If the BCC detects an error in the source file, it stops reading commands into the device configuration. The BCC imports commands from the file -- up to, but not including -- the command line where the error occurred.

Syntax for the **source** command is as follows:

source *<volume>*:*<filename>*

Example:

source 2:bn.cfg

Saving the Active Configuration as a Bootable File

When you finish using BCC commands to modify an existing configuration, save the new configuration to a file on an NVFS (flash) volume. (At boot time, the router loses any configuration changes not previously saved to an NVFS volume.) To save *config* as a bootable binary file on a volume you specify, enter:

save config *<volume>*:*<filename>*

Chapter 4
Tutorial: Configuring a Nortel Networks Router

This chapter provides a tutorial that guides you through the initial configuration of a Nortel Networks router using the BCC. It includes the following sections:

Topic	Page
Creating and Modifying a Device Configuration	4-1
Sample Router Configuration	4-2
Disabling a Configured Object	4-15
Enabling a Configured Object	4-16
Deleting a Configured Object	4-17

Creating and Modifying a Device Configuration

You configure a Nortel Networks device by defining a set of objects, starting at the root level of the device's configuration hierarchy. Each object has a set of parameters with values set either by you or by the device software.

Following is a typical BCC configuration sequence:

1. Open a Technician Interface session and start the BCC interface.
2. Start BCC configuration mode.
3. Use BCC configuration commands to create new objects in the device configuration and modify default values for parameters of each object to meet the requirements of your network.
4. Enable any global protocols not enabled automatically by the BCC, for example, TFTP and Telnet Server.
5. Use the **save** command to save your configuration as a bootable (binary) file on the device.

6. Exit BCC configuration mode, exit the BCC to the Technician Interface, and log out of the device.

You may find it helpful to first diagram what you want to configure in terms of the BCC configuration tree or hierarchy for the device. Refer to the following sample router configuration.

Sample Router Configuration

The following example shows a sequence of commands you can use to configure a BCN router on a network. You first complete the physical installation of the router, then boot the router using the image (*bn.exe*) and the minimum configuration file (*ti.cfg)*.

This example creates the following objects in the total router configuration (Figure 4-1):

- IP (global)
  - -- ARP (global) on IP
  - -- RIP (global) on IP
- SNMP (global)
  - -- Community “public” on SNMP
  - -- Manager (address 0.0.0.0) on community “public”
- FTP (global)
- TFTP (global)
- Telnet (global)
  - -- Server (global) on Telnet
- Quad Ethernet interface in slot 13
  - -- IP interface (address 192.168.133.114) on Ethernet connector 1
    - ARP on IP interface 192.168.133.114
    - RIP on IP interface 192.168.133.114

- Serial interface in slot 5
- Dual token ring interface in slot 9
- FDDI interface in slot 11

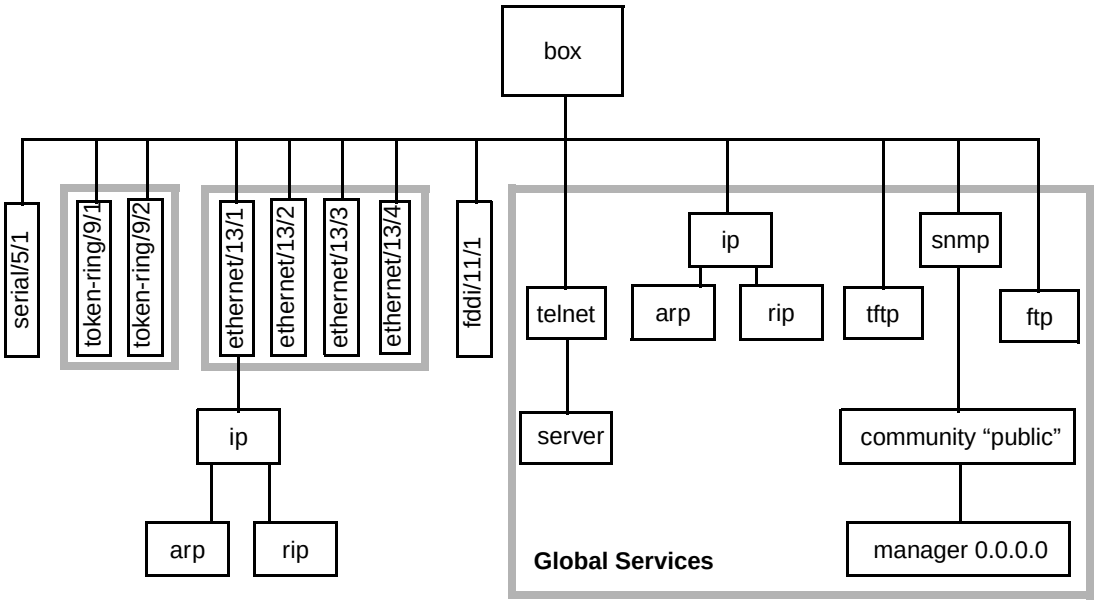


Figure 4-1. Sample BCC Configuration (BCN Router)

After you create a diagram of the device configuration tree, configure the device using a cycle of BCC configuration commands similar to those shown in Figure 4-2.

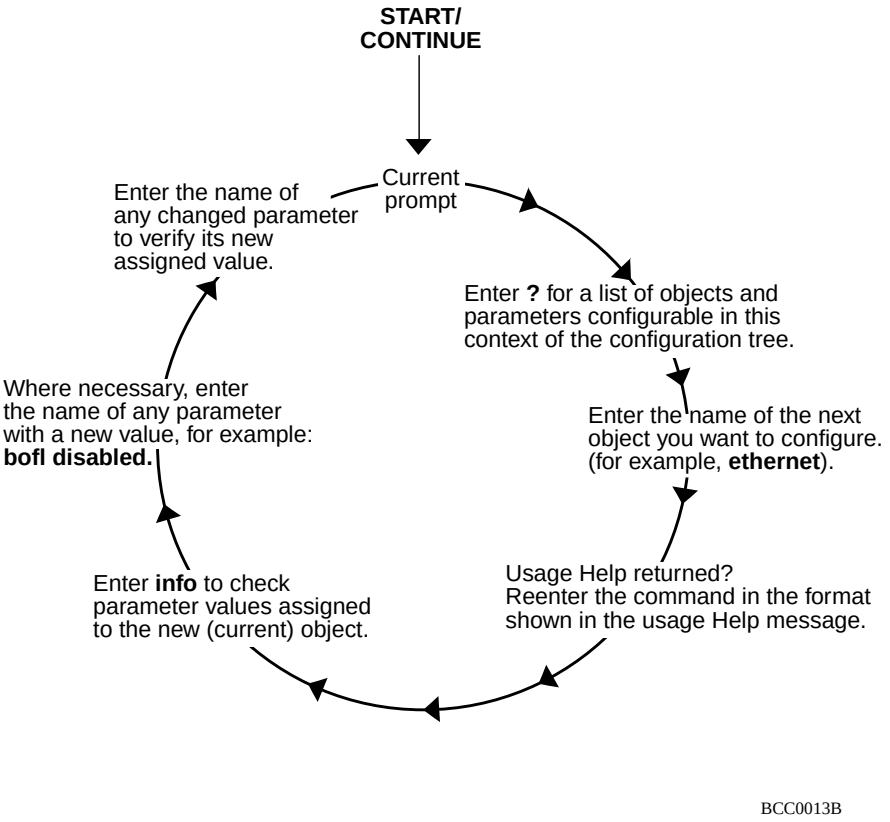


Figure 4-2. Typical BCC Configuration Cycle

To create the sample configuration shown in Figure 4-1 using BCC commands:

1. **Log on to the router as Manager, so that you can modify the device configuration.**

```
Nortel Networks, Inc. and its Licensors.
Copyright 1992, 1993, 1994, 1995, 1996, 1997, 1998. All rights
reserved.

Login: Manager
Mounting new volume...
Device label:
Directory: 2:
New Present Working Directory: 2:

Welcome to the Backbone Technician Interface

   Router1>
```

2. **Start the BCC by entering bcc at the Technician Interface prompt.**

```
Router1> bcc

   Welcome to Bay Command Console!

   * To enter configuration mode, type config

   * To list all system commands, type ?

   * To exit the BCC, type exit

bcc>
```

3. **Enter BCC configuration mode by entering config.**

```
bcc>  config
box#
```

4. **Check the hardware configuration of the router.**

```
box# show config -all

box type frecn (BCN router with a FRE-2 controller)
   board slot 5
      type sync (Serial link module in slot 5)
   back
   board slot 7
      type srml (System resource module in slot 7)
    back
   board slot 9
      type dtok (Dual token ring link module in slot 9)
   back
   board slot 11
      type wffddi2m (Multimode FDDI link module in slot 11)
   back
   board slot 13
      type qenf (Quad Ethernet with filters in slot 13)
   back
   console portnum 1 (console device on port 1)
      prompt {"%slot%:"}
      auto-manager-script automgr.bat
      auto-user-script autouser.bat
    back
   back
   box#
```

Note how the output of the **show config** command automatically includes navigation (**back**) commands. If you save this output to a file, you can reenter the commands automatically using the BCC **source** command. (See "Importing Configuration Commands from a File" on page 3-15.)

For descriptions of the values of the board type parameter, see the *Release Notes*.

5. **Choose a port (interface type, slot, and connector) for the initial IP interface to the router.**

```
box# ethernet slot 13 connector 1
ethernet/13/1#
```

6. Check to see what you can configure (subcontexts and parameters) at this level.

```
ethernet/13/1# ?
Sub-Contexts:
  auto-neg        ip              ipx

Parameters in Current Context:
  bofl                    circuit-name            receive-queue-length
  bofl-retries            connector               slot
  bofl-timeout            hardware-filter         state
  bofl-tmo-divisor        on                      transmit-queue-length

System Commands:
  To list all system commands, type "help commands".
  For detailed help on a specific command, type "help <command>".

ethernet/13/1#
```

Based on the subcontexts list, you can add **autoneg** (Ethernet speed autonegotiation), **ip** (interface IP), or **ipx** (interface IPX) to this Ethernet port. The list of configurable objects depends on the *board* type described in the current prompt. For example, 100BASE-T modules additionally allow you to configure an “autoneg” (autonegotiation) object at this level.

You can also modify the values currently assigned to the parameters in current context list (parameters of ethernet/13/1).

Note: For the BCC to display the list of system commands in response to **help commands**, you must have:

- Installed a copy of *bcc.help* on a memory card in the device
- Configured the location of the help file (usually **2:bcc.help**) by assigning that value to the *help-file-name* parameter of the root-level (box or stack) object.

7. Add IP (address 192.168.133.114) to ethernet/13/1.

```
ethernet/13/1# ip 192.168.133.114
Usage: "ip address <value> mask <value>"
Or:    "ip <address>/<mask>"
Required parameter "mask" was not specified for ip.
```

The error message appears because the BCC requires you to enter a mask value whenever you create an IP interface. Because the first octet of the address is 192 (0xC0), this is a Class C address, requiring the first 3 octets to be the network portion of the interface address. You can express the corresponding mask value as either 255.255.255.0 (using dotted-decimal notation) or 24 (the number of bits making up the network portion of the IP interface address), as follows:

```
ethernet/13/1# ip 192.168.133.114/24
ip/192.168.133.114/255.255.255.0#
```

The BCC converts the integer representing the number of mask bits into a dotted-decimal mask value, as shown in the last prompt.

8. Check the values currently assigned to parameters of IP on this interface.

```
ip/192.168.133.114/255.255.255.0# info
  state enabled
  address 192.168.133.114
  mask 255.255.255.0
  assocaddr 0.0.0.0
  cost 1
  broadcast 0.0.0.0
  configured-mac-address 0x
  mtu-discovery off
  mask-reply off
  all-subnet-broadcast off
  address-resolution arp
  proxy off
  host-cache-aging cache-off
  udp-checksum on
  end-station-support off
  redirects on
  cache-size 128
```

9. Change the subnet mask to 255.255.255.224.

```
ip/192.168.133.114/255.255.255.0# mask 255.255.255.224
"mask" parameter may not be modified
ip/192.168.133.114/255.255.255.0#
```

You cannot modify any parameter values included in the BCC instance ID of a configured object, in this case, ip/192.168.133.114/255.255.255.0. To change the value of any parameter that is part of a BCC instance ID, you must first delete the object, then re-create it with the desired parameter values. In this case, you must delete the IP interface and then re-create it on ethernet/13/1, using the mask value of 255.255.255.224, as follows:

```
ip/192.168.133.114/255.255.255.0# delete
ethernet/13/1# ip 192.168.133.114/255.255.255.224
ip/192.168.133.114/255.255.255.224#
```

10. Check to see what you can configure at this level.

```
ip/192.168.133.114/255.255.255.224# ?
Sub-Contexts:
  arp     dvmrp   igmp    ospf    rdisc   rip

Parameters in Current Context:
  address                 configured-mac-address  mtu-discovery
  address-resolution      cost                    on
  all-subnet-broadcast    end-station-support     proxy
  assocaddr               host-cache-aging        redirects
  broadcast               mask                    state
  cache-size              mask-reply              udp-checksum

System Commands:
  To list all system commands, type "help commands".
  For detailed help on a specific command, type "help <command>".
```

You can modify values currently assigned to parameters of ip/192.168.133.114/255.255.255.224, or you can add ARP, DVMRP, IGMP, OSPF, Router Discovery, or RIP to this interface.

11. Add RIP as the routing protocol (by default, RIP1) on this interface.

```
ip/192.168.133.114/255.255.255.224# rip
rip/192.168.133.114#
```

12. Return to root (box) level to configure global system services.

```
rip/192.168.133.114# box
box#
```

13. Check which global services and interfaces you can configure at this level.

```
box# ?
Sub-Contexts:
  access          dns             ip              serial          tunnels
  atm             ethernet        ipx             snmp            virtual
  backup-pool     fddi            isdn-switch     syslog          wcp
  board           ftp             mce1            telnet
  console         hssi            mct1            tftp
  demand-pool     http            ntp             token-ring

Parameters in Current Context:
  build-date      description     mib-counters    type
  build-version   help-file-name  on              uptime
  contact         location        system-name

System Commands:
  To list all system commands, type "help commands".
  For detailed help on a specific command, type "help <command>".
```

You can add any of the following global services (affecting all slots) listed under Sub-Contexts: access, backup-pool, demand-pool, dns, ftp, http, ip, ipx, ntp, snmp, syslog, telnet, tftp, and wcp.

You can add any of the following interfaces: atm, ethernet, fddi, hssi, serial, token-ring, or virtual.

You can view but not modify the parameters of any board object.

14. List the objects already configured at box level.

```
box# lso
board/11        board/5         board/9         ethernet/13/1
board/13        board/7         console/1       ip
box#
```

When you added the first instance of IP to the box (ip/192.168.133.114/255.255.255.224), the BCC automatically created the global IP object at box level.

15. Add SNMP to the device.

```
box# snmp
snmp#
```

16. Check what you can configure next at this level.

```
box# snmp
snmp# ?
Sub-Contexts:
  community       trap-entity     trap-event

Parameters in Current Context:
  authentication-traps    lock-timeout            state
  lock                    on                      type-of-service
  lock-address            scope-delimiter

System Commands:
  To list all system commands, type "help commands".
  For detailed help on a specific command, type "help <command>".
```

You can modify values currently assigned to parameters of SNMP, and you can add a community, define a trap entity, or define a trap event.

17. View the parameter definitions using the BCC help command.

```
snmp# help snmp

                              snmp Parameters:
   ____________________________________________________________________

   state
          Indicates the administrative state of this object (enabled or
          disabled).

   authentication-traps
          Sends trap for sets from false Mgr or Community.

   lock
          Allows the locking mechanism to be disabled.

   lock-address
          Allows the lock address to be cleared.

   lock-timeout
               .                   .                   .
               .                   .                   .
               .                   .                   .
```

18. Define the SNMP community “public.”

```
snmp# community public
community/public#
```

19. **Check the values currently assigned to parameters of this SNMP community.**

```
community/public# info
  on snmp
  label public
  access read-only
  scope-type {}
```

20. **To allow network management applications (such as Site Manager) to modify the device configuration, change the value of the access parameter to read-write**.

```
community/public# access read-write
community/public#
```

21. **Define an SNMP manager for the router.**

```
community/public# manager
Usage: "manager address <value>"
Or:    "manager <address>"
Required parameter "address" was not specified for manager.
```

    The BCC error message indicates what you left out and automatically provides usage help on how to configure an SNMP manager.

22. **Try again to add the manager, this time supplying a value for its required parameter, address. (You must enter a value for a required parameter, but you can omit the name of the parameter.)**

```
community/public# manager 0.0.0.0
manager/public/0.0.0.0#
```

23. **Enable the Telnet server entity on the router.**

```
manager/public/0.0.0.0# telnet
telnet#  server
server#
```

24. **Add TFTP services globally to the router.**

```
server# tftp
tftp#
```

    The BCC automatically searches back (toward root) to find the parent context suitable for Telnet and TFTP (in this case, box). The BCC then adds Telnet and TFTP to the device configuration. Note the new (`tftp#`) prompt.

25. Check the values currently assigned to parameters of TFTP.

```
tftp# info
  on box
  state enabled
  default-volume 2
  retry-timeout 5
  close-timeout 25
  retry-count 5
```

26. Change the default volume number for TFTP to 5.

```
tftp# def 5
tftp#
```

27. Verify the change to the default volume number.

```
tftp# def
  default-volume 5
```

28. Add FTP globally to the router.

```
tftp# ftp
ftp#
```

The BCC automatically searches back (toward root) to find the parent context suitable for FTP (in this case, box). The BCC then adds FTP to the device configuration. Note the new (`ftp#`) prompt.

29. Check the definitions for parameters of FTP.

```
ftp# help ftp
                              ftp Parameters:
   ____________________________________________________________________

   on
          Identifies the parent(s) of this object.

   state
          Indicates the administrative state of this object (enabled or
          disabled).

   default-volume
          Specifies the default volume where transferred files are
          written/retrieved.
     .       .       .
     .       .       .
     .       .       .
```

30. Check values currently assigned to parameters of FTP.

```
ftp# info
  on box
  state enabled
  default-volume 2
  login-retries 3
  idle-timeout 900
  max-sessions 3
  tcp-window-size 60000
```

31. Change the default volume number to 5.

```
ftp# def 5
ftp#
```

32. Verify the change to the default volume number.

```
ftp# def
  default-volume 5
```

33. Recheck the total device configuration.

```
ftp# show config -all
box type frecn
  board slot 5
      type sync
  back
  board slot 7
      type srml
  back
  board slot 9
      type dtok
  back
  board slot 11
      type wffddi2m
  back
  board slot 13
      type qenf
  back
  console portnum 1
      prompt {"%slot%:"}
      auto-manager-script automgr.bat
      auto-user-script autouser.bat
  back
  ethernet slot 13 connector 1
      circuit-name E131
    ip address 192.168.133.114 mask 255.255.255.224
     .       .       .
     .       .       .  (remaining configuration not shown here)
```

34. **Return to root level.**

```
ftp# box
box#
```

35. **Save the file using a name other than *config* until you can test the configuration.**

```
box#  save config startup.cfg
```

36. **Test the intial IP interface.**

```
box#  ping 192.168.133.114
IP ping: 192.168.133.114 is alive (size = 16 bytes)
```

37. **Ensure that the initial IP interface connects to another device on the network.**

```
box# ping 192.168.133.97
IP ping: 192.168.133.97 is alive (size = 16 bytes)
```

38. **When you finish configuring the router, exit configuration mode.**

```
box#  exit
bcc>
```

39. **Exit the BCC, which returns you to the Technician Interface prompt.**

```
bcc>  exit
Router1>
```

40. **Enter the logout command to close your console or Telnet session with the router.**

```
Router1> logout
```

Disabling a Configured Object

In most cases, the BCC automatically enables objects that you add to the device configuration. However, you can disable an object to manage or troubleshoot the device. Here is a BN router example of how to disable an object (rip) on ip/1.2.3.4/255.0.0.0:

1. **Specify the configuration context for the object you want to disable.**

```
box#  ethernet/2/1;ip/1.2.3.4/255.0.0.0;rip
rip/1.2.3.4#
```

2. **Disable RIP.**

```
rip/1.2.3.4#  disable
rip/1.2.3.4#
```

3. **Verify that you disabled RIP.**

```
rip/1.2.3.4#  state
  state disabled
rip/1.2.3.4#
```

You can also disable an object from its parent context, using the following syntax:

disable *<BCC_instance_identifier>*

Example:

```
ip/1.2.3.4/255.0.0.0#  disable rip/1.2.3.4
ip/1.2.3.4/255.0.0.0#
```

Using this method, you remain in the current context after disabling the branch object.

Enabling a Configured Object

If you disable a configured object, you can use the BCC **enable** command to reenable that object. Here is a BN router example of how to enable an object (rip) previously disabled on ip/1.2.3.4/255.0.0.0:

1. **Specify the configuration context for RIP.**

```
box#  ethernet/2/1;ip/1.2.3.4/255.0.0.0;rip
rip/1.2.3.4#
```

2. **Reenable RIP.**

```
rip/1.2.3.4#  enable
rip/1.2.3.4#
```

3. **Verify that you reenabled RIP.**

```
rip/1.2.3.4#  state
  state enabled
rip/1.2.3.4#
```

You can also enable an object from its parent context, using the following syntax:

enable *<BCC_instance_identifier>*

Example:

```
ip/1.2.3.4/255.0.0.0#  enable rip/1.2.3.4
ip/1.2.3.4/255.0.0.0#
```

Using this method, you remain in the current context after enabling the branch object.

Deleting a Configured Object

Because of the tree hierarchy, objects on higher branches of the tree depend on the state (and existence) of objects closer to the root of the tree. Deleting an object also deletes anything configured on that object.

Caution: Before using the BCC to delete an interface, make sure that you did not use Site Manager to configure it with a protocol that the BCC does not recognize. If you did, use Site Manager to delete the interface.

Here is a BN router example of how to delete an IP interface from the active device configuration:

1. **Navigate to the object you want to delete.**

```
box#  ethernet/13/1
ethernet/13/1#  ip/192.168.133.114/255.255.255.224
ip/192.168.133.114/255.255.255.224#
```

2. **List all objects configured on the current object.**

```
ip/192.168.133.114/255.255.255.224# lso
arp/192.168.133.114/1   rip/192.168.133.114
```

3. **Delete the object.**

```
ip/192.168.133.114/255.255.255.224#  delete
ethernet/13/1#
```

4. **Verify that you deleted the object.**

```
ethernet/13/1# lso
```
(no objects listed)

Note that ip/192.168.133.114/255.255.255.224 no longer appears in the list of objects configured on ethernet/13/1. With a single **delete** command, the BCC automatically deleted the branch objects (arp/192.168.133.114/1 and rip/192.168.133.114) configured on ip/192.168.133.114/255.255.255.224.

You can also delete an object by entering the following command from its parent context:

delete *<BCC_instance_identifier>*

Example:

```
ip/1.2.3.4/255.0.0.0#   delete rip/1.2.3.4
ip/1.2.3.4/255.0.0.0#
```

Using this method, you remain in the current context after deleting the branch object.

Appendix A
Multilevel Access

The Technician Interface provides, by default, two user logins: *Manager* and *User,* stored in nonvolatile RAM (NVRAM). The Manager login allows you to enter any system command and allows read-write access to the device configuration. The User login allows you to enter only user-level system commands and allows read-only access to the device configuration.

The multilevel access feature allows you to:

- Define multiple user groups, names, passwords, and privileges for access to the Technician Interface.
- Manage the distribution of user names, passwords, and access privileges.
- Authenticate users by either local (MIB) or remote (RADIUS) mechanisms.
- View event logs showing each BCC command executed and the user name that executed the command.

Multilevel Access Login

To access a Nortel Networks router using this feature, enter your login ID at the `Login` prompt, and enter your password at the `Password` prompt on your Telnet or console display:

`Login:` *<login_id>*

`Password:` *<password>*

The Technician Interface prompt appears, enabling you to subsequently enter the **bcc** command to start the BCC interface.

How Access Is Granted

Multilevel access grants access to a device by checking for a recognized name/password pair. The login process proceeds as follows:

- If the user name is Manager or User (the default logins), the name/password pair is checked in NVRAM. If a match is found, access is granted with Manager or User privileges.
- If the user name is not Manager or User, and RADIUS is enabled, the name/password pair is checked on the configured RADIUS server. If a match is found, access is granted at the assigned privilege level. For more detailed information about enabling RADIUS, see *Configuring RADIUS.*
- If the user name is not Manager or User, and RADIUS is not enabled (or no match is found), the name/password pair is checked in the MIB of the device. If a match is found, access is granted at the assigned privilege level.
- If none of these scenarios produces a match to the name/password pair, or if both the Access object and RADIUS are disabled, access is denied and the user is prompted for a new name/password pair.

Access Privileges

A user's privilege level determines the system commands a user can execute. In addition to the existing manager and user privilege levels, a third level, that of operator, has been added. A manager privilege level account allows you to enter any system command and allows read-write access to the device configuration. An operator privilege level account allows you to execute most system commands, and allows limited access to the device configuration. A user privilege level account allows user level system commands and allows read-only access to the device configuration.

If you attempt to execute a command that requires a higher privilege level an error message will occur. For example, if a user privilege level account attempts to execute a manager privilege level command the following error is displayed:

```
[1:1]$ bcc
bcc# config
Insufficient privilege
access#
```

To assign access privileges, assign the user to a group (or create and assign the user to a new group) that has the desired privilege level. For a list of system commands and the privilege level required to execute them, refer to Appendix B, "System Commands."

Access Security

You can view the information for multilevel access configured users (logins, groups, audit-level, and so on) in the device configuration file, except passwords which are encrypted.

There is no way to view passwords in an unencrypted form. A manager privilege level account can change the password of any user, but only if the existing password is known. If you wish to change a user's password and do not know the original password, you will need to reconfigure the user's account information and assign a new password.

Sharing Access Profiles

To share user access profiles configured on one router across multiple routers:

1. **Navigate in BCC configuration mode to a multilevel access context that you want to replicate on another router.**
2. **From the desired context, enter the following command:**

   show config -recursive -file *<filename>*
3. **Transfer the file from the local router to a target router.**
4. **Log on to the target router and enter BCC configuration mode.**
5. **Use the BCC source command to import access profiles from the transferred file into the device active configuration.**
6. **Exit, then reenter the BCC on the target router.**
7. **Enter show config -all to see your changes.**

For more information about using the **show config** and **source** commands, refer to Chapter 3, "Entering Commands and Using Command Files."

Configuring Multilevel Access

Multilevel access is configured by default at the root level. Information about the default Manager and User logins is stored in nonvolatile RAM (NVRAM). Information about other configured users is stored in the device configuration file or RADIUS server (passwords encrypted). Only one user can make changes to the configuration at a time.

Figure A-1 shows the multilevel access configuration branch:

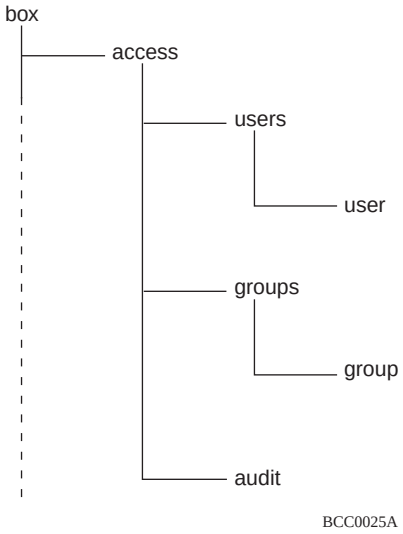


Figure A-1. Configurable Multilevel Access Objects

Configuring Access

The access object lets you set the minimum and maximum character string lengths for user and group names and passwords. You can also enable or disable the configuration of accounts from the access prompt.

To configure access, navigate to the `access` prompt (for example: **box; access**) and enter values (or accept the default values) for the following parameters (Table A-1):

Table A-1. Access Parameter Options

Parameter	Description	Default	Options
maximum-login-length	Maximum number of characters allowed for a login name	16	1-16
minimum-login-length	Minimum number of characters allowed for a login name	4	1-16

(continued)

Table A-1. Access Parameter Options *(continued)*

Parameter	Description	Default	Options
maximum-group-length	Maximum number of characters allowed for a group name	16	1-16
minimum-group-length	Minimum number of characters allowed for a group name	4	1-16
maximum-password-length	Maximum number of characters allowed for a password	16	1-16
minimum-password-length	Minimum number of characters allowed for a password	0	0-16
configuration-accounts	Enable or disable the configuration of accounts	enabled	enabled, disabled
radius-server-accounts	Enable or disable the configuration of RADIUS server accounts	disabled	enabled, disabled

For example, to set the minimum password length to 6 characters, enter:

```
box# access
access# minimum-password-length 6
access#
```

Configuring User

Configuring the user object lets you set the profile for an individual user.

To configure the user object, navigate to the `users` prompt (for example: **box; access; users**) and enter values (or accept the default values) for the following parameters (Table A-2):

Table A-2. User Parameter Options

Parameter	Description	Default	Options
state	Administrative state of this object	enabled	enabled, disabled
login-id	Login name of this user	none	*<string>*
true-name	True name of this user	none	*<string>*
encrypted-password	Encrypted password of this user	none	*<string>*

(continued)

Table A-2. User Parameter Options *(continued)*

Parameter	Description	Default	Options
group-ids	Group ID numbers with which this user name is associated	1	all-groups, 1-31
audit-level	Privilege level activity to include in the audit log	manager, user, operator	all, manager, user, operator

For example, to create the login ID for a user, enter:

```
box# access
access# users
users# user login-id david
user/david#
```

Configuring Group

Configuring the group object lets you set the profile for a group of users.

To configure group, navigate to the `groups` prompt (for example: **stack; access; groups**) and enter values (or accept the default values) for the following parameters (Table A-3):

Table A-3. Group Parameter Options

Parameter	Description	Default	Options
state	Administrative state of this object	enabled	enabled, disabled
name	Name of this group	none	*<string>*
group-id	ID number of this group	none	1-31
privilege-level	Privilege level of this group	user	all, manager, user, operator
audit-level	Privilege level activity to include in the audit log	manager, user, operator	all, manager, user, operator

For example, to create the group name and group ID, enter:

```
stack# access
access# groups
groups# group name admin group-id 1
group/admin#
```

Configuring Audit

The audit log includes the name of the command, the name of the user that issued the command, and a timestamp for all commands of the privilege level you specify. You can disable this feature by setting the parameter state to disabled.

To configure audit, navigate to the `audit` prompt (for example: **stack; access; audit**) and enter values (or accept the default values) for the following parameters (Table A-4):

Table A-4. Audit Parameter Options

Parameter	Description	Default	Options
state	Administrative state of this object	enabled	enabled, disabled
audit-level	Privilege level activity to include in the audit log	manager, user, operator	all, manager, user, operator

For example, to disable the audit log, enter:

```
stack# access
access# audit
audit# state disabled
audit#
```

Disabling or Deleting Users and Groups

When a user entry in the device configuration file is disabled or deleted, the current active session of the user terminates. When a group entry in the device configuration file is disabled or deleted, affected users assume the highest privilege level of any remaining assigned groups. If all the groups a user belongs to are disabled or deleted, the current active session of the user terminates.

BCC Lock Messages

Multilevel access includes messages that identify which user has exclusive read-write access to the device configuration.

The additional lock messages take the generic form:

`read-write mode in use by` *<login_id>* `from` {*console* | *<ip_address>*}`, use -force to override.`

Example:

```
read-write mode in use by testuser1 from 192.168.133.99, use -force
to override
```

This message appears when a user in BCC config mode is logged in using a Telnet session. The message contains the user's login name and the IP address of the workstation from which the user initiated the session.

Example:

```
read-write mode in use by Manager from console, use -force to
override
```

This message appears when the user in BCC config mode is logged in at the console connected to the router.

Example:

```
SNMP user from 192.168.133.99 has the configuration locked, use
-force to override.
```

This message appears when an SNMP station has locked, exclusive read-write access to the device configuration. The message identifies "SNMP" and the IP address of the workstation from which that user initiated the session.

For information on SNMP locking, see *Configuring SNMP, BootP, DHCP, and RARP Services.*

Example:

```
SNMP General Set Error. Machine is currently locked by manager
255.255.255.255
```

This message appears when a Site Manager user attempts to open a dynamic configuration session on the same box with a BCC user currently in configuration mode.

The user login and the string 255.255.255.255 indicate to the Site Manager user that this is a BCC session.

Example:

```
Snmp Error: Setting File System Action.
```

This message appears when a Site Manager user attempts to use File Manager to transfer a file to or from a router that has a BCC user in configuration mode.

Appendix B
System Commands

The BCC supports the system commands listed in Table B-1.

For more detailed information about any command that works from the Technician Interface as well as the BCC prompt:

- Enter **help** *<command>* at any BCC prompt (for example, **help save**).
- See *Using Technician Interface Software.*

Table B-1. System Commands

Command	Purpose	Login/Access Privileges		
		Manager	Operator	User
?	List the names of objects, parameters, and system commands you can enter next.	✔	✔	✔
<command> **?**	Display syntax usage Help for *<command>.*			
<object> **?**	List parameters of an object you can access or configure from your current level in the device configuration tree.			
<parameter> **?**	List the current, default, and legal values for this parameter of the current object.			
<object> *<parameter>* **?**	List the current, default, and legal values for the specified parameter of this object.			
! [*<n>*] (Technician Interface only)	Repeat the last command, or repeat the last command *<n>* times.	✔	✔	✔
back [*<n>*] (BCC configuration mode only)	Move your current working location back *<n>* levels closer to the root level of the BCC configuration tree.	✔	✔	✔
bcc	Start the BCC from the Technician Interface prompt.	✔	✔	✔
boot [{*<vol>*:*<image_name>* | -} {*<vol>*:*<config_name>* | -}]	Reboot the system.	✔		
cd [*<vol>*:][*<directory>*]	Set or display the current working volume and directory.	✔	✔	✔
clear *<subcommands>* *<flags>*	Clear specific device information, such as IP and RIP data.	✔		
clearlog [*<slot_ID>*]	Clear all previous events from the system event log.	✔		
commit	Commit (make effective) new values that you assign to MIB attributes.	✔		

(continued)

Table B-1. System Commands *(continued)*

Command	Purpose	Login/Access Privileges		
		Manager	**Operator**	**User**
compact *<volume>*:	Compact existing files into a contiguous address space on a volume, and compact all unused space into a single contiguous block of free space for new files on the same volume.	✔		
config [-read-write|-read-only] (BCC only)	Enter BCC configuration mode. If you logged on as Manager or Operator, you have read-write access to the device configuration; if you logged on as User, you have read-only access, which allows you to display the existing configuration, but prevents you from changing the configuration. If you enter BCC configuration mode as Manager and want to change your privilege level for the current session from read-write to read-only, enter **config -read-only**. To change Manager privileges back to read-write, enter **config -read-write**.	✔	✔	✔
copy *<vol>:<filename1> <vol>:<filename2>* (Technician Interface only)	Copy the contents of the first file to the second file.	✔		
cp *<vol>:<filename1> <vol>:<filename2>* (BCC only)	Copy the contents of the first file to the second file.	✔		
cwc [**..**]	Change working context (config mode only). Issued with the .. argument, **cwc** changes from the current configuration context to root level. Issued without any argument, **cwc** changes from the current working context to the previous (parent) configuration context.	✔	✔	✔

(continued)

Table B-1. System Commands *(continued)*

Command	Purpose	Login/Access Privileges		
		Manager	Operator	User
date [*<mm/dd/yy>*] [*<hh:mm:ss>*] [{+|-}*<hh:mm>*]	Display or update the system time and time zone.	✔	✔	✔
delete *<filename> <volume>* (Technician Interface only; see **rm** for BCC equivalent)	Delete the file from the specified volume.	✔		
delete [*<BCC_instance_ID>*] (BCC configuration read-write mode only)	Delete the object described in the current prompt, or delete the object known by the specified *<ID>* and configured previously from the current level.	✔		
diags [*<slot _ID>*]	Perform CPU/memory, backbone, and link diagnostics before downloading the GAME image and rebooting on the specified slot.	✔		
dinfo	Display the status of each file system volume on this device.	✔	✔	✔
dir [*<vol>***:**]	Display the contents of the file system volume specified.	✔	✔	✔
disable (BCC configuration read-write mode only)	Disable the object at your current location in the BCC configuration tree.	✔	✔	
enable (BCC configuration read-write mode only)	Enable the object at your current location in the BCC configuration tree.	✔	✔	
format *<volume>*:	Erase the entire contents of the file system volume specified and reinitialize it to a usable state.	✔		
get {*<obj_name>*|*<obj_id>*} **.**{*<attr_name>*|*<attr_id>*|*} [.{*<inst_id>*|*}] (Technician Interface only)	Retrieve the values of data objects in the MIB.	✔	✔	✔

(continued)

Table B-1. System Commands *(continued)*

Command	Purpose	Login/Access Privileges		
		Manager	**Operator**	**User**
getcfg (Technician Interface, AN routers only)	Display network boot parameters. (Display the current parameter settings used to determine the source of image and configuration files.)	✔	✔	✔
help	Display an overview of BCC Help-oriented features.	✔	✔	✔
help *<command>*	Display detailed Help on a specific command.	✔	✔	✔
help commands	Display an alphabetical list of all commands, with syntax and terse descriptions.	✔	✔	✔
help commands -more	Display syntax and more detailed command descriptions for all BCC commands in alphabetical order.	✔	✔	✔
help *<object_name>*	Display definitions for parameters of the currrent object. For example, **help ip ospf** defines parameters of the global ospf object, and **help ethernet** defines parameters of an Ethernet port object.	✔	✔	✔
help *<parameter_name>*	Display definitions of all parameters of the current object. For example, **help bofl** displays the definitions of all parameters of **ethernet**.	✔	✔	✔
help syntax	Display Help on how to interpret BCC syntax symbols.	✔	✔	✔
help [*<task>*]	Display Help on how to perform a specific task. The **help** commands are **help learning-bcc** and **help editing**.	✔	✔	✔
help tree [-all]	Display a hierarchical list of all objects you can configure on this platform (use **-all**) or on the current object (omit **-all**).	✔	✔	✔

(continued)

Table B-1. System Commands *(continued)*

Command	Purpose	Login/Access Privileges		
		Manager	**Operator**	**User**
help [*<command>* | **-all**] (Technician Interface only)	The **help** command, entered without arguments at the Technician Interface prompt, displays an alphabetical list of all commands with syntax only. The list excludes commands available only in BCC mode. The combination **help** *<command>* displays detailed Help on a specific command, excluding any commands available only in BCC mode. The combination **help -all** displays detailed Help on all system commands, excluding those available only in BCC mode.	✔	✔	✔
history [*<n>*] (*<n>* option Technician Interface only)	Display the command history list or, for the Technician Interface only, recall command number *<n>* from the history list.	✔	✔	✔
info (BCC configuration mode only)	List values currently assigned to all configurable parameters of this object.	✔	✔	✔
ip *<subcommand> <flags>* (Technician Interface only)	Display data from IP; show a different view for each subcommand or flag you enter.	✔	✔	✔
ip6 *<subcommand> <flags>* (Technician Interface only)	Display data from IPv6; show a different view for each subcommand or flag you enter.	✔	✔	✔
list [*<instances>* [*<obj_name>*]] (Technician Interface only)	List objects in the MIB.	✔	✔	✔
loadmap [*<slot_list>* | **all**] [*<filepath>*]	Display the load address and size of each dynamically loadable application (for example, a protocol).	✔	✔	

(continued)

Table B-1. System Commands *(continued)*

Command	Purpose	Login/Access Privileges		
		Manager	**Operator**	**User**
log [*<vol>*:*<logfile>*] [**-d***<date>*] [**-t***<time>*] [**-e"***<entity>"*] [**-f***<severity>*] [**-s***<slot_ID>*] [**-p***<rate>*] [**-c***<code #>*]	Display the current system event log. Follow the optional **-e** flag immediately with the entity name in uppercase characters and enclosed in quotation marks (no intervening spaces). Specify *<severity>* using letters with no intervening spaces: f = fault w = warning i = info t = trace d = debug **Examples:** -fwid -ffitd -fwi -fwitd Use the optional **-p** flag to set an interval for polling the log and displaying the result.	✔	✔	✔
log [**-x**|**-i**] [**-e"***<entity>"*] [**-f***<severity>*] [**-s***<slot_ID>*]	Exclude (**-x**) or include (**-i**) event logging indicated by the command options.	✔	✔	✔
log -z [**-s***<slot_ID>*]	Display current filter setting.	✔	✔	✔
logout	Exit the current login session.	✔	✔	✔
lso [-l] (BCC configuration mode only)	List objects configured on the current object. The optional **-l** flag causes the BCC to list object IDs in wraparound screen format.	✔	✔	✔
mget {*<obj_name>* | *<obj_id>*} . {*<attr_name>* | *<attr_id>* | **} [. {*<inst_id>* | **}] (BCC only)	Retrieve the values of data objects in the MIB.	✔	✔	✔
mlist [instances [*<obj_name>*]**]** (BCC only)	List objects in the MIB.	✔	✔	✔
more [on | off] [*<#_lines_per_screen>*]	Set or display the status of the **more** utility.	✔	✔	✔

(continued)

Table B-1. System Commands *(continued)*

Command	Purpose	Login/Access Privileges		
		Manager	**Operator**	**User**
mset {*<obj_name>*|*<obj_id>*} .{*<attr_name>*|*<attr_id>*} .{*<inst_id>*} {*<value>*} (BCC only)	Modify (set) the values of data objects in the device MIB.	✔	✔	
partition {create|delete} [*<vol>***:**]	Create or delete a partition on existing file system media.	✔	✔	✔
password Manager	Change the password of the Manager account.	✔		
password User	Change the password of the User account.	✔	✔	✔
ping -*<protocol> <address>* [**-t***<timeout>*]	Initiate an ECHO request/reply handshake.	✔	✔	✔
pktdump *<line_number>* [**-s***<start>*] [**-c***<count>*]	Display packets that have been captured by an interface configured for Packet Capture.	✔		
prom [**-v|-w**] *<vol>*:*<ROM_Update_File> <slot_ID>* [*<slot_ID>*...]	Update or verify the software located on a flash PROM device.	✔		
pwc (BCC configuration mode only)	Display the path to your current working location in the tree, starting from root.	✔	✔	✔
readexe *<vol>*:*<filename>*	Validate the checksums of an executable image and print out all the file header information.	✔	✔	✔
record {open|close} [-fileonly] [-pause] *<vol>*:*<filename>* (Technician Interface only)	Record to a file all messages written to the terminal. You can open, pause, and close a recording session.	✔		
reset [*<slot_ID>*]	Reboot the GAME image on the specified slot. If the slot ID argument is absent, reboot the entire device.	✔		

(continued)

Table B-1. System Commands *(continued)*

Command	Purpose	Login/Access Privileges		
		Manager	Operator	User
restart [*<slot_ID>*]	Restart the GAME image on the specified slot. If the slot ID argument is absent, the GAME image restarts on all slots.	✔		
rm *<vol>***:***<filename>* (BCC only)	Remove (delete) the file from the specified volume.	✔		
save {config | aliases | log} *<vol>***:***<filename>*	Store the current configuration, alias list, or system event.	✔	✔	
securelogin	Turn SecurID access to the device on and off via Telnet.	✔		
set {*<obj_name>* | *<obj_id>*} .{*<attr_name>*|*<attr_id>*} . {*<inst_id>*} {*<value>*} ... (Technician Interface only)	Modifies data objects in the MIB.	✔		
show config [-all] [-recursive] [-verbose] [-compact] [-file *<filename>***] [-compact]** (BCC only)	Display the active configuration of the current object, plus any other configuration data implied by the command filters, -a, -r, -v, -c, and -f. See "Displaying Current/Active Configuration Data" on page 2-8".	✔	✔	✔
source *<vol>***:***<filename>*	Read BCC configuration or TCL scripting commands from a text file.	✔		
source {aliases | env | perm} *<vol>*:*<filename>* (Technician Interface only)	Read a list of aliases, environment variables, or dynamic permissions from a file.	✔	✔	
stamp	Display the device image version name and timestamp.	✔	✔	✔
system (Technician Interface only)	Start a new Technician Interface session that allows you to run system manager privileged commands.	✔	✔	✔

(continued)

Table B-1. System Commands *(continued)*

Command	Purpose	Login/Access Privileges		
		Manager	**Operator**	**User**
telnet [**-d**] [**-e** *<escape_char>*] [*<host_ip>* [*<port>*]] (Technician Interface and BCC top level only; not available in BCC configuration mode)	Communicate with other hosts supporting the Telnet protocol.	✔	✔	✔
tftp {get | put} *<address>* *<vol>***:***<filename>* [*<vol>***:***<filename>*] (Technician Interface and bcc> top level only)	Send files to, or retrieve files from, other hosts supporting TFTP.	✔		
type [**-x**] *<vol>***:***<filename>*	Display the contents of the designated file in ASCII or HEX (**-x**) format.	✔	✔	✔
xmodem {rb | sb} [**y** l **w | p** | **n**] *<filename>* **...**	Transfer files to or from this device over a dial (out-of-band) connection.	✔		

Appendix C
TCL Support

The BCC supports the following subset of Tool Command Language (TCL) scripting commands on the router platform:

- **append**
- **break**
- **case**
- **catch**
- **close**
- **concat**
- **continue**
- **eof**
- **error**
- **eval**
- **exit**
- **expr**
- **flush**
- **for**
- **foreach**
- **gets**
- **global**
- **if**
- **incr**
- **interp**
- **join**
- **lappend**
- **lindex**
- **linsert**
- **list**
- **llength**
- **lrange**
- **lreplace**
- **lsearch**
- **lsort**
- **open**
- **proc**
- **puts**
- **rename**
- **return**
- **set**
- **source**
- **split**
- **subst**
- **switch**
- **unset**
- **uplevel**
- **upvar**
- **while**

For more information about definitions, syntax, and applications for these TCL commands, refer to the following book:

Ousterhout, J. *Tcl and the Tk Toolkit*. ISBN 0-201-63337-X. Reading, Mass.: Addison-Wesley, 1994.

Appendix D
System show Commands

This appendix describes the following BCC system **show** commands.

Topic	Page
show access	D-2
show console	D-4
show hardware	D-7
show interface	D-9
show process	D-10
show syslog	D-13
show system	D-16

Note: For information about the **show config** command, see "Displaying Configuration Data" on page 2-8.

show access

The **show access** *<option>* command displays information about multiuser access.

The **show access** command supports the following subcommand options:

active	groups	lock	users

active

Displays information about each active user. The table includes the following information:

Login-id	Login name of this user.
Login Time	Time this user logged in.
Idle Time	Time elapsed since the last command was issued.
State	State of this user (config or active).
From	Originating IP address or console.
Port	Port from which this user is accessing the device.
Last Command	Last command issued by this user.

groups

Displays information about each active group. The table includes the following information:

Group	Group number.
Name	Group name.
State	State of this group (enabled/disabled).
Privileges	Privilege level for this group.
Audit	Privilege level activity to include in the audit log.

lock

Displays information about the lock status of the user currently in configuration mode. The table includes the following information:

Slot	Device number of the slot being accessed.
Lock User	User currently in configuration mode.
From	Originating IP address or console.
Port	Port from which this user is accessing the device.
Idle Time	Time elapsed time since the last command was issued.

users

Displays information about each active user's profile. The table includes the following information:

Login Name	Login name of this user.
State	State of this user (enabled/disabled).
True Name	True name of this user.
Groups	Group ID numbers of this user.
Audit	Audit level for this user.

show console

The **show console** *<option>* commands display console port configuration and statistics information.

The **show console** command supports the following options:

config	stats

config

Displays configuration and Technician Interface environment information for the serial ports configured on your system or for a specific port.

The table includes the following information:

Port Number	Port number for the information displayed. Valid ports are 1, 2, 3, and 4. Not all systems have four physical ports. A configured port that does not exist is in the Absent state.
State	Port's current state, as follows: • *Absent* - Not physically present • *Disabled* - Unavailable • *Down* - Unavailable • *Init* - Initializing • *Up* - Available
Port Name	Name that the system assigns to the port. You cannot specify a name. You can use the name to correlate a port number to a physical port. The name of the port should be printed next to the physical port connection, for example, Port 1 - CONSOLE. The names do not specify the port's use. All ports are serial ports used for Technician Interface sessions only. For example, port MODEM1 may be a modem connection or a dummy terminal connection depending on its configuration. Although port 4 is called PRINTER, it is exactly like ports 1, 2, and 3. Port 4 doesn't support a printer. Port 4 is called PRINTER only because that label is printed near the port connector on the link module.
Slot Number	Slot on which the login session for the serial port is running.
Baud Rate	Current baud rate setting for the serial port.
Data Bits	Number of data bits in the serial port's configuration.

Parity	Serial port's current parity setting.
Stop Bits	Number of stop bits in the serial port's configuration.
Modem Enable	Configuration of modem control, as follows: • *Disabled* - Port is directly connected to a device, such as a dummy terminal or a terminal server. • *Enabled* - Port is attached to a modem and modem leads are enabled.
Lines/Screen	Number of lines that the serial port displays before displaying the more prompt.
More Enable	Setting of the Technician Interface **more** feature: Enabled or Disabled (according to the MIB record). The Technician Interface **more** command affects only the current login session; it does not change the MIB, and so does not affect the setting of this field.
Port Prompt	Technician Interface prompt.
Login Retries	Maximum number of login retries; relevant only if modem control is enabled. This value determines the maximum number of failed login attempts that a system allows on the serial port. If the maximum occurs, the system hangs up on the line, causing a modem connection to lose carrier detect.
Login Timeout (min.)	Number of minutes allowed between when the system displays the login banner and a user enters a login ID; relevant only if modem control is enabled. If this timeout occurs, the system hangs up on the line.
Password Time Out	Number of minutes allowed to enter a password. If this timeout period expires, the system hangs up on the line.
Command Time Out	Command line timeout value; relevant only if modem control is enabled. If you do not enter a command in this number of minutes, the system hangs up on the serial port.
User Abort Logout	Switch to execute control (^C) to break out of the user autoscript. When a user autoscript is in effect and this parameter is enabled, you can break out of the script when logged in as User, but not as Manager. Also, if this parameter is enabled and the script terminates due to an error, the system automatically logs you out.
Initial Search Path	List of file system volumes to be searched when you run a script without a volume specifier or if an autoscript does not contain a volume specifier. The environment variable PATH is set to this string. The string format is as follows: *<vol>*:[;*<vol>*: ...] Example: 2:;3:;4:;5:

Manager's AutoScript	Name of the script to run when the Manager account logs in to the router. If the script name does not contain a volume specifier, the system searches the volumes listed in "Initial Search Path."
User's AutoScript	Name of the script to run when the User account logs in to the router. If the script name does not contain a volume specifier, the system searches the volumes listed in "Initial Search Path."
History Depth	Maximum number of Technician Interface commands stored in the local command history table. The table stores each command you enter at the prompt on a first in first out (FIFO) basis.
# files to autosave	Number of times that the system saves the events log to a new file automatically when the log is full.
Volume for autosave	The target volume where the system stores new log files saved through the log autosave feature.

stats

Displays login information and console port error statistics.

The table includes the following information:

Port Number	Port number for the information displayed.
Port Name	Corresponding port name.
Port State	Port's current state: Absent, Disabled, Down, Init, or Up.
Total Logins	Number of logins (failed and successful) on the console port.
User Login Errors	Number of failed login attempts that the User login account has made on the console port.
Manager Login Errors	Number of failed login attempts that the Manager login account has made on the console port.
Other Login Errors	Number of failed login attempts made by login accounts other than User and Manager on the console port.
TTY Frame Errors	Number of frame errors on the console port.
TTY Overrun Errors	Number of overrun errors on the console port.
TTY Parity Errors	Number of parity errors on the console port.
TTY FIFO Errors	Number of FIFO errors on the console port.

A high number of errors over a short period of time may indicate a problem with the line.

show hardware

The show hardware <option> commands display information about router hardware.

The **show hardware** command supports the following subcommand options:

backplane	memory [<slot>]
config_file	proms
image	slots

backplane

Displays information about the state of the backplane hardware. The table includes the backplane type, revision, and serial number. The revision and serial numbers are in decimal format.

config_file

Displays the configuration file used to boot the router or reset a slot. The table shows the volume and file name used as the source of the configuration. The table also shows the date and load time.

image

Displays the router's software image for each slot, including the integration that is the source of the image, the date and time of the image's creation, and the file name that contains the image.

memory [<*slot*>]

Displays memory configuration and capacity information about all slots or a specific slot. The table includes the following information:

Slot	Slot number.
Local Memory	Total memory capacity in megabytes of the processor on the slot.
Global Memory	Current memory configuration in megabytes of the processor on the slot.
Total Memory	Total local and global memory in megabytes.

proms

Displays PROM information for all slots. The table includes the revision and build date of the bootstrap PROM and the diagnostics PROM.

slots

Displays hardware information about all slots in the system. The table includes information about the processor module and link module for each slot, as well as the module type, revision, and serial number. The revision and serial numbers are in decimal format.

For the AN, the table indicates that the AN has an 802.3 repeater (HUB) by indicating that the link module is an ANSEDSH.

For the ASN, the table displays the revision and serial number of the chassis, processor module, and the network module type, revision, and serial number.

show interface

The **show interface** command displays information about all media-specific interfaces configured on the device. This command has only one option, **summary**.

summary

Displays high-level information about each media-specific interface. To see greater detail, use a **show** *<media_type>* command, such as **show ethernet** *<option>*.

The table for **show interface summary** includes the following information:

Interface Name	Name of the interface.
Admin State	State requested by the user (per RFC 1213).
Oper State	Actual state determined by the system (per RFC 1213).
Media Type	Type of LAN/WAN media supporting the interface.
Protocols	Protocols configured on the interface.

show process

The **show process** *<option>* commands display information about the use of resources (buffers, CPU, memory, lists, and so on) on the router.

The **show process** command supports the following subcommand options:

buffers [detail | total]	list [detail | total]
cpu [detail | total]	memory [detail | total]

buffers [detail | total]

Displays the number and percentage of buffers used by all processes on the router.

The table includes the following information:

Name	Name of the process (if you specify the detail option).
Slot	Slot number.
Used	Number of buffers used.
%Used	Percentage of buffers used.
Max	Maximum buffers (if you specify the total option).
Free	Free buffers (if you specify the total option).

cpu [detail | total]

Displays the CPU usage in hundredths of seconds and the percentage of total CPU time used by all processes on the router.

detail	Displays details about CPU usage for all processes.
total	Displays only CPU statistics totals.

Note: For information about how to obtain a list of available processes, see the **show process list** command.

The table includes the following information:

Name	The name of the process.
Slot	Slot number.
Used	Hundredths of seconds used by each process.
%Used	Percentage of CPU time used by each process.
Idle	CPU idle time in hundredths of seconds.
Max	Total CPU time in hundredths of seconds.

list [detail | total]

Displays a list of all the processes running on each slot.

show process list [**detail** | **total**]

The table includes the following information:

Name	The name of the process.
Slot	Slot number.

memory [detail | total]

Displays the number of bytes and the percentage of memory used by all processes on the router.

detail	Displays details about the amount of memory used by each process running on the router.
total	Displays only memory usage totals.

The table includes the following information:

Name	The name of the process (if you specify the detail option).
Slot	Slot number.
Used	Number of memory bytes used by each process.
%Used	Percentage of memory used by each process.
Free	Number of free buffers on this slot (if you specify the total option).

show syslog

The **show syslog** *<option>* commands let you obtain Syslog statistical data from the management information base (MIB).

The show syslog command supports the following subcommand options:

base	log-host	filter

base

Displays statistics for the Syslog global entity. This command has no optional filters (flags).

The table includes the following information:

State	Configured state of the Syslog service
Maximum Active Hosts	Maximum number of remote Syslog hosts configured to receive messages from this device
Poll Iteration Timer	Number of seconds that Syslog waits to reinitiate a polling cycle across all slots
Operational State	Actual state of the Syslog service (up/down)
# Active Seq. Hosts	Number of hosts receiving time-sequenced Syslog messages from the router
# Active Non-seq. Hosts	Number of hosts receiving Syslog messages on a slot-by-slot basis from the router
# Messages Sent	Total number of Syslog messages forwarded to all remote Syslog hosts configured on this device

log-host

Displays statistics associated with any Syslog log-host object configured on the device. This command supports the following command filters (flags) and filter arguments:

-log-host *<IP_address>*]	Displays statistics for all Syslog hosts configured on this device. Adding an IP address causes the command to display the statistics of a specific Syslog host.
-active	Displays the list of remote hosts configured and receiving Syslog messages from this router.
-inactive	Displays the list of remote hosts configured but not receiving Syslog messages from this router.
-enabled	Displays **log-host** objects that have a configured state of enabled.
-disabled	Displays **log-host** objects that have a configured state of disabled.

The table includes the following information:

Host IP Address	Address of a remote Syslog host.
Configured State	Administrative state of a configured **log-host** object.
Operational State	Actual (active/inactive) state of a configured **log-host** object. Active means that the associated host is actively receiving Syslog messages from the router. Inactive means that the host is not receiving Syslog messages from the router.
Time Sequencing	Status of Syslog message time-sequencing (enabled/disabled) for the associated remote host.
UDP Port	UDP port where the remote host receives Syslog messages from the router.
Facility Code	System facility that the remote UNIX host uses to receive and process Syslog messages from the router.
# Messages Sent	Total number of messages sent to the remote host.

filter

Displays statistics of entity filters configured on the router. This command supports the following command filters (flags) and filter arguments:

-log-host *<IP_address>*	Displays all filters configured for this remote host
-name *<log_host_name>*	Displays the filter with this name
-entity *<entity_name>*	Displays filters configured for this entity
-active	Displays filters in the active state
-inactive	Displays filters in the inactive state
-enabled	Displays filters with a configured state of enabled
-disabled	Displays filters with a configured state of disabled

The table includes the following information:

Host IP Address	IP address of the remote host
Filter Name	Name assigned to the filter
Entity Name	Entity associated with the filter
Configured State	Administrative state of the filter
Operational State	Actual (active/inactive) state of the filter

show system

The **show system** *<option>* commands display information about the overall system state.

The **show system** command supports the following subcommand options:

buffers	memory
drivers	protocols
information	tasks

buffers

Displays the current buffer usage for all active slots on the router. Because buffers circulate rapidly through the system, a low free percentage does not necessarily indicate a buffer shortage; it may be a transient condition.

The table includes the following information:

Slot	Slot number.
Used	Number of buffers used by each process.
%Free	Percentage of free buffers on each slot.
Total	Total number of buffers available.
Free	Total number of free buffers.

drivers

Displays link modules and drivers installed on all slots. If the configuration displayed differs from that expected, your configuration file may be incorrect (wrong module type specified, for example) or there may be a problem loading the software.

information

Displays general system information (system name, contact, node location, image data, MIB version, and total uptime since last cold boot).

memory

Displays the global memory usage for all active slots in the system. Memory usage is not as volatile as buffer usage, so a low free percentage may indicate that you need more memory.

The table includes the following information:

Slot	Slot number.
Total	Total number of memory (DRAM) bytes available on each slot.
Used	Number of memory bytes used on each slot.
Free	Amount of free memory on each slot.
%Free	Percentage of free memory on each slot.

protocols

Displays the protocols installed on all slots in the system. If the configuration displayed differs from that expected, your configuration file may be incorrect (wrong protocol specified, for example) or there may be a problem loading the software.

tasks

Displays the number of tasks scheduled to run on all slots. This number is highly volatile and a large In Queue value does not necessarily indicate a problem.

The table includes the following information:

Slot	Slot number.
Total	Total number of tasks running on each slot.
In_Queue	Number of tasks scheduled to run.
% in Queue	Percentage of tasks scheduled to run.

Appendix E
Syntax for Module Location

Table E-1 lists the syntax for specifying the physical location of a module for each Nortel Networks device that the BCC supports.

Table E-1. Syntax for Specifying Module Location per Device

Platform	Syntax
AN/ANH	*<interface> <slot> <connector>* • *<interface>* = interface type: ethernet, token-ring, serial, etc. • *<slot>* = 1 (AN/ANH is a one-slot device). • *<connector>* numbering starts with connector 1. ***Example:*** **ethernet slot 1 connector 3** This is an Ethernet interface configured on AN/ANH connector 3, which exists on an Ethernet adapter module. (Connectors 1 and 2 are on the base module.)
ASN	*<interface> <slot> <module> <connector>* • *<interface>* = interface type: ethernet, token-ring, serial, etc. • *<slot_number>* = 1, 2, 3, or 4, depending on the setting of the module ID switch on each ASN. • *<module>* numbering corresponds to net module numbering (1 through 4) on each ASN. • *<connector>* numbering starts at 1 on each net module (per media type). ***Example:*** **ethernet slot 2 module 3 connector 2** This is an Ethernet interface on connector 2 of net module 3, in ASN 2 of a stacked ASN configuration.

(continued)

Table E-1. Syntax for Specifying Module Location per Device *(continued)*

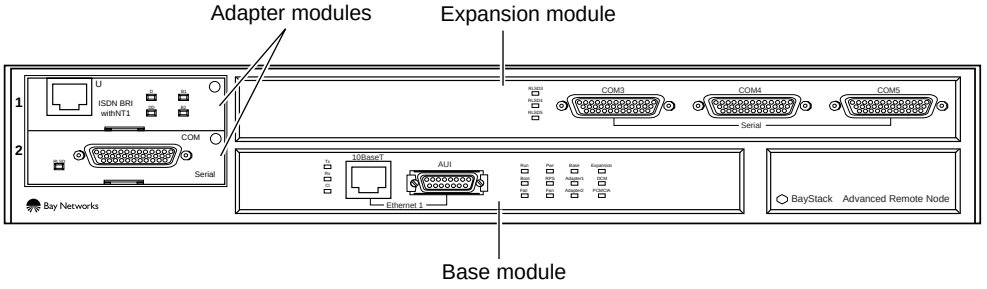
Platform	Syntax
ARN	*<interface> <slot> <connector>* • *<interface>* = interface type: ethernet, token-ring, serial, etc. • *<slot>* = 1 (The ARN is a 1-slot device.) • *<connector>* numbering depends on the port type (LAN or WAN). LAN connector numbering starts at 1 on the base module, which contains only LAN ports. LAN connector numbering continues in ascending order, starting with the first LAN port on an ARN expansion module. (The ARN expansion module plugs into the ARN base module.) WAN connector numbering starts with connector 1 on WAN adapter module 1, continues with connector 2 on WAN adapter module 2, and ascends sequentially with WAN connectors 3 through *n* on the ARN expansion module.  ARN0006A ***Example:*** **ethernet slot 1 connector 2** This interface is configured on LAN connector 2, which exists physically on an Ethernet expansion module. (Ethernet connector 1 is on the base module.) ***Example:*** **serial slot 1 connector 3** This is a serial (WAN) interface configured on WAN connector 3, which exists physically on the ARN expansion module.

Table E-1. Syntax for Specifying Module Location per Device *(continued)*

Platform	Syntax
BN	*<interface> <slot> <connector>* • *<interface>* = interface type: ethernet, token-ring, serial, etc. • *<slot>* = 2 through 5 (BLN) or 1 through 14 (BCN). • *<connector>* numbering starts with connector 1 on each slot (per media type). ***Example:*** **ethernet slot 8 connector 3** This is an Ethernet interface configured on connector 3 of slot 8 of a BCN router.
System 5000	*<interface> <slot> <module> <connector>* • *<interface>* = interface type: ethernet, token-ring, serial, atm, etc. • *<slot_number>* = 2 through 13 in a System 5000 chassis • *<module>* numbering corresponds to net module 1 or 2, which plugs into a System 5000 base module. A System 5000 base module is always module 3. • *<connector>* numbering starts at 1 on each net module. The base module always contains a connector 1, which plugs into a System 5000 backplane (for example, Ethernet, token ring, or ATM backplane). ***Example:*** **ethernet slot 2 module 2 connector 1** This is an Ethernet interface on connector 1 of the Ethernet net module (module 2) in slot 2. **atm slot 2 module 3 connector 1** This is an ATM interface on connector 1 of slot 2, a Model 5782 Virtual Network Router (VNR) base module (module 3). Note that the VNR does not accommodate any net modules.

Appendix F
BN Console Slot Election

The BCC console slot election feature allows you to specify slots eligible to run the router console interface. From a list of slots that you specify, the software elects the slot with the greatest amount of available free memory. This feature helps ensure that the BCC has enough startup and runtime memory to operate.

This feature currently applies only to multislot router platforms (BCN and BLN). BN routers have only one physical port supporting a directly attached console device or a modem, the latter for remote access to the console port.

By default, the console slot election routine runs transparently when all eligible slots are up and running and any of the following events occurs:

- You press the console Return key at the initial router `Login:` prompt.
- The router displays the login Welcome message.
- You log out, and then log in to the router from the console device.
- You reboot the router from its console device.

If you log in to a BN router using a Telnet connection, the Technician Interface and the BCC run only on the slot associated with that inbound Telnet session. The console slot election feature is inactive.

By default, the console slot election feature is enabled and considers all slots eligible to run the console interface. However, you can:

- Customize the selection of slots used by the console slot election routine (see "Using the BCC to Customize Console Slot Election" on page F-2).
- Disable or reenable the console slot election routine (see "Disabling and Reenabling Console Slot Election" on page F-2).

Using the BCC to Customize Console Slot Election

To limit the choice of slots considered by the console slot election routine:

1. **Log on to the router.**
2. **Start the BCC.**
3. **Enter BCC configuration mode.**
4. **Check the current value of the console-slot-mask parameter used to configure the console slot election feature.**

   ```
   box# console-slot-mask
   console-slot-mask {1 2 3 4 5 6 7 8 9 10 11 12 13 14}
   ```

   Each number represents a router slot.
5. **Enter a new value (list of slots) for the console-slot-mask parameter, for example:**

   ```
   box# console-slot-mask {2 3 4 5 11}
   ```
6. **Save the new configuration to a file, for example:**

   ```
   box# save config new.cfg
   ```

To restore the default settings for the console slot election feature at any time, go to the box# prompt and enter:

console-slot-mask all

This is equivalent to:

console-slot-mask {1 2 3 4 5 6 7 8 9 10 11 12 13 14}

If you want to save the restored default value for console-slot-mask, repeat step 6.

Disabling and Reenabling Console Slot Election

If you know that a BN router has sufficient memory (DRAM) to run the console interface and the BCC simultaneously on any slot, you can disable the console slot election feature, as follows:

1. **Log on to the router.**
2. **Start the BCC.**
3. **Enter BCC configuration mode.**

4. **Enter the following command:**

   console-slot-mask none

If you want to permanently disable the console slot election feature, save this new configuration to a file.

To reenable the console slot election routine at any time, start the BCC, enter configuration mode, and enter any BN slot numbers or **all** as the console-slot-mask parameter value.

Examples:

console-slot-mask {2 3 4}

console-slot-mask 5

console-slot-mask all

Console Slot Election Error Message

If the slot chosen by the console slot election routine does not have sufficient free memory to run the BCC, the router displays an error message:

```
$ bcc
** Error ** Unable to load bcc command from file system.
Loadable Module: bcc.exe
```

If this condition occurs, you cannot start the BCC on the currently elected slot. In this case, try the following corrective actions:

- Log out of the router, and then log in again (rerunning the console slot election process).
- Enter the Technician Interface **show system memory** command to examine the amounts of available free memory on each slot.
- Use the Technician Interface **set** command to specify a different set of slots eligible to run the console interface. (Set a new value for the wfIpInterfaceSlotMask attribute of the Wellfleet-SYS-MIB.) For more information about using the Technician Interface, see *Using Technician Interface Software*.
- If the amount of available free memory is low, you can upgrade the amount of DRAM installed on one or more router slots to at least 16 MB.

Appendix G
Configuring Syslog Services

This appendix provides information on configuring and managing Syslog services. It includes the following sections:

Topic	Page
Overview of the Syslog Service	G-1
Configuring Syslog on the Router	G-8
Managing Syslog Services	G-17
Customizing Syslog Operation	G-20
Syslog Parameter Descriptions	G-23

Overview of the Syslog Service

You can use the BayRS Syslog messaging service to capture and process router event messages on any UNIX-based network management platform. The Syslog component of the router software supports this messaging function by communicating with a UNIX daemon named *syslogd* on your management workstation. The *syslogd* daemon receives and locally logs, displays, prints, and forwards messages that originate from local and external sources.

Figure G-1 illustrates Syslog and *syslogd* functions.

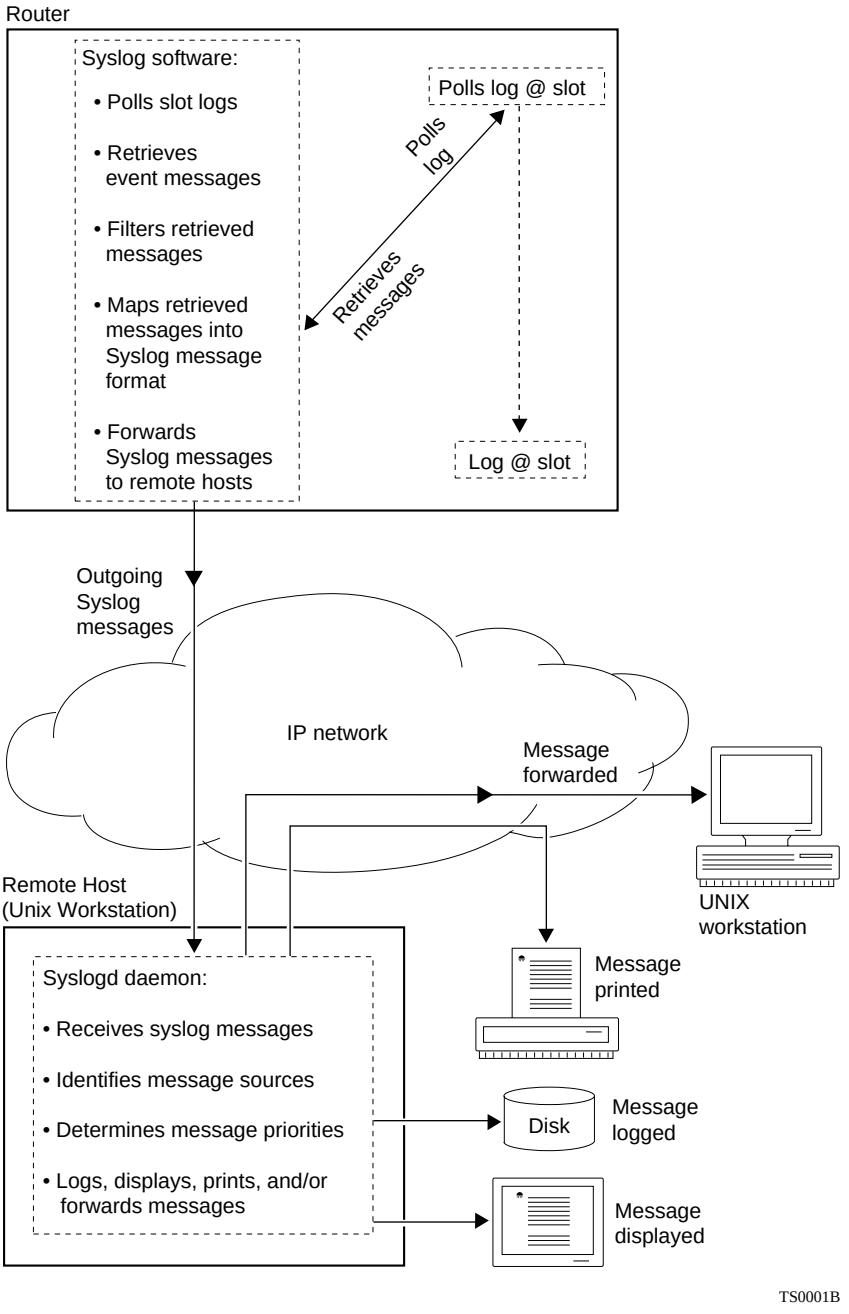


Figure G-1. Syslog and *syslogd* Operations

On each slot, Syslog performs the following functions:

- Polls the local events log buffer to retrieve new event messages
- Selects event messages that meet the requirements of entity filters that you configure on the router
- Maps the messages it retrieves into Syslog message format
- Inserts a priority code into each reformatted message
- Orders messages chronologically, if you first enabled the message sequencing feature
- Forwards messages to IP on the router, which in turn forwards messages to remote hosts identified in the Syslog host table

At a remote UNIX management workstation, *syslogd*:

- Receives Syslog messages from Nortel Networks routers
- Examines the priority code in each message
- Determines the system handling for each message
- Dispatches each message to any or all of the following destinations:
  - -- Workstation display
  - -- Local log file
  - -- Designated printer
  - -- One or more remote hosts

Entity Filters

Each protocol and system service in the router software has a unique entity name, which is contained in each event message originated by that entity. For a complete list of BayRS entity names and their corresponding internal entity numbers, refer to the BayRS documentation CD or access the event message database at:

http://support.baynetworks.com/library/tpubs/events

You configure *entity filters* on each router to capture only the messages that you specify.

You can filter event messages by:

- Entity name
- Event number
- Event severity level
- Device slot number

Figure G-2 illustrates how an entity filter limits the number of event messages that Syslog forwards from a router to a specific remote host.

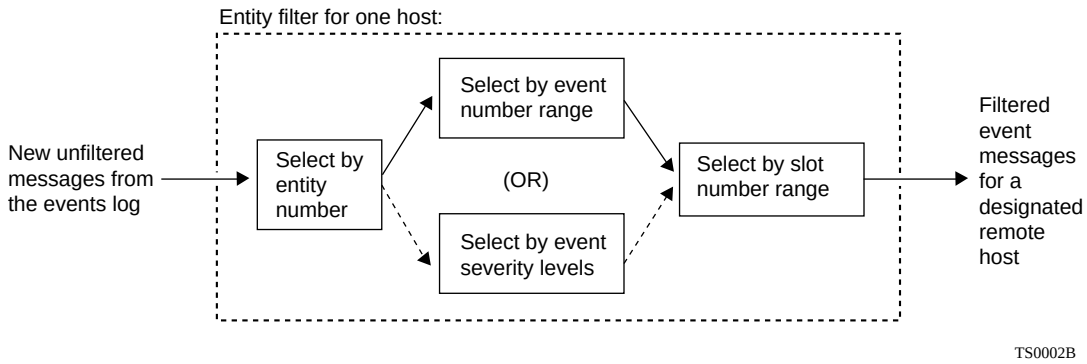

Entity filter for one host:
New unfiltered messages from the events log
Select by entity number
Select by event number range
(OR)
Select by event severity levels
Select by slot number range
Filtered event messages for a designated remote host
TS0002B

Figure G-2. Router Event Message Filtering for One Host

You can configure an entity filter to do one of the following:

- Capture from one entity all messages that fall within a numbered range of events.
- Capture from all entities messages logged with specific severity levels.

Syslog forwards all captured events to the hosts identified in the BCC Syslog configuration.

Syslog Message Format

Syslog running on each slot maps filtered event messages into Syslog message format. For example, the following system log message

```
#1: 02/07/95 16:03:18.679 INFO SLOT2  FTP  Code:5
FTP is initializing.
```

looks as follows in Syslog format:

```
<AE>FTP: SLOT:2 SEVERITY:Info ENTITY_CODE/EVENT_CODE:88/5
FTP is initializing.
```

Figure G-3 shows how Syslog encapsulates a message into a UDP packet.

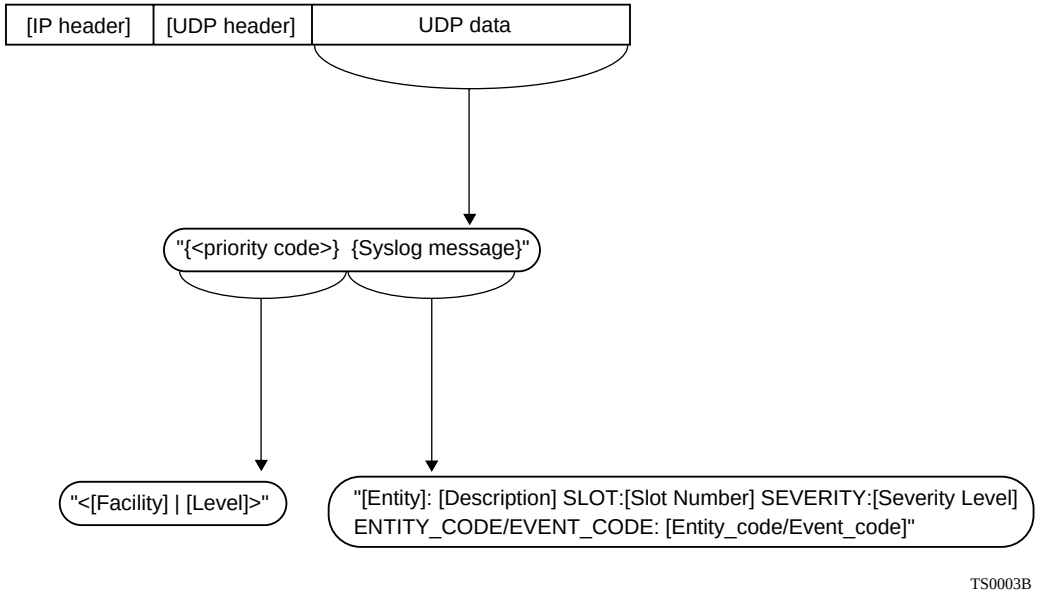


Figure G-3. Syslog Message Encapsulation

The following paragraphs describe the fields in a Syslog packet shown in Figure G-3 (for an event message that matches all filtering criteria).

IP Header -- Syslog adds the destination IP address for a specific remote host.

UDP Header -- Syslog adds the destination UDP port number on the remote host identified in the IP header.

UDP Data -- The UDP data field in the Syslog packet contains a reformatted router event message plus a priority code required by the remote host. The remote host uses this information to decide how to handle messages received from a router.

Priority Code -- A priority code and its text consist of a facility code plus an error-level code in the form *facility.error* (Figure G-4).

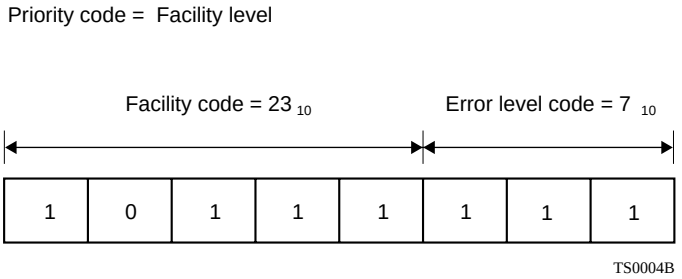


Figure G-4. Syslog Message Composition

Facility Codes

The facility code identifies a standard UNIX system facility that receives a message from an internal or external software entity. The “Local <0-7>” UNIX system facilities receive event messages (in Syslog format) from routers in the network. The following table relates UNIX system facility names to their respective facility codes on a workstation.

UNIX System Facility Name	Facility Code (equivalent decimal value)
Local 0	1
Local 1	2
Local 2	3
Local 3	4
Local 4	5
Local 5	6
Local 6	7
Local 7	8

Severity Levels

The error-level code identifies the level of urgency of a received message for UNIX system-handling decisions. The following table shows one way to map UNIX system error codes and error levels to the severity levels of event messages from a Nortel Networks router.

UNIX System Error Codes	UNIX System Error Levels	Nortel Networks Router Event Message Severity Levels
1	LOG_EMERG	Fault
2	LOG_ALERT	Warning
3	LOG_CRIT	Warning
4	LOG_ERR	Warning
5	LOG_WARNING	Warning
6	LOG_NOTICE	Info
7	LOG_INFO	Info
8	LOG_DEBUG	Debug, Trace

You determine how the severity levels of Nortel Networks router event messages map to error levels on your UNIX workstation based on the requirements of the network management application you use.

For instructions on how to map router event messages to UNIX system error level codes, see "Mapping Router Message Severity Levels to UNIX System Error Levels" on page G-21.

Sequenced Messaging

If you enable the time-sequencing feature, Syslog captures and forwards in timestamped order all event messages captured by entity filters on the router.

With time-sequencing disabled, Syslog forwards event messages to the remote hosts according to the order of slots polled on the router.

For instructions on how to enable the time-sequencing feature, see "Enabling Sequential Syslog Messaging" on page G-23.

Note: Enable time sequencing only when it is important for your management workstation to receive router event messages in timestamped order. When you enable the time-sequencing feature, Syslog requires more processing resources from the router.

Viewing Event Messages from a Network Device

To view event messages from a Nortel Networks router, open the file you designated on the workstation to receive Syslog messages from routers in your network.

For More UNIX Syslog Information

See the instructions provided in the UNIX manual (man) pages on your network management workstation for more information about Syslog, *syslogd*, and *syslog.conf*.

Configuring Syslog on the Router

The following steps describe generally how to configure Syslog on the router:

1. **Configure *syslogd* on a UNIX workstation.**
2. **Using the console attached to the router, or using a Telnet connection to the router, log in to the Technician Interface.**
3. **Start the BCC and enter configuration mode.**
4. **Add Syslog to the router configuration.**
5. **Configure a remote host to receive Syslog messages from the router.**
6. **Configure entity filters for the new remote host.**
7. **Enable system auditing (box; access; audit state enabled).**
8. **Save your new router configuration to a file.**
9. **Exit your BCC session.**

Figure G-5 shows the BCC configuration hierarchy for Syslog services on the router.

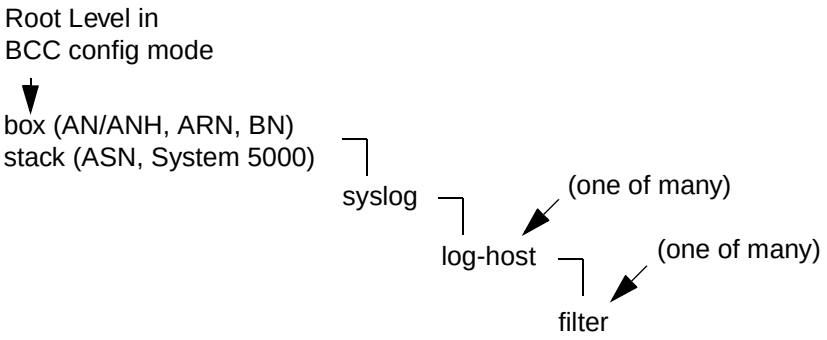


Figure G-5. BCC Configuration Hierarchy for Syslog Services

The following sections describe each step in the Syslog configuration sequence.

Configuring *syslogd* on a UNIX Workstation

Before you configure and activate Syslog on any routers, configure *syslogd* on UNIX network management workstations in your network. This helps prevent the loss of event messages that you may want to capture as you begin to enable Syslog on each router.

For *syslogd* to properly dispatch event messages, you must edit the */etc/syslog.conf* file, in which you define destinations for the event messages.

Configure *syslogd* on your UNIX workstation, as follows:

1. **Log in as superuser:**

   su root

2. **Open the *syslog.conf* file and examine the facility level indicators, which are in the form local<*0 - 7*>.<*fault* | *warning* | *info* | *trace* | *debug*>.**

3. **Edit *syslog.conf* to accommodate message handling for your management workstation.**

4. **Save the changes you made to *syslog.conf*.**

5. **Obtain the process ID for the *syslogd* process currently running on the workstation by entering:**

   ps

6. **Reinitialize *syslogd* by entering:**

   kill -HUP *<process_id>*

Starting the BCC

To start the BCC interface, log in to the Technician Interface and enter the **bcc** command at the prompt:

```
Router1> bcc

     Welcome to the Bay Command Console!

     * To enter configuration mode, type config

     * To list all system commands, type ?

     * To exit the BCC, type exit


bcc>
```

If you need more information about how to log in to a Nortel Networks router, see *Using Technician Interface Software*.

To enter BCC configuration mode, enter:

```
bcc> config
Reading configuration information, please wait . . . done.
box#
```

On AN®, ANH™, ARN™, and BN® routers, the BCC interface returns the root level prompt, `box#`, upon entering configuration mode. For ASN and System 5000™ routers, the root-level prompt in configuration mode is `stack#`.

Adding Syslog to the Router Configuration

To add Syslog services globally to the router configuration, enter:

```
box# syslog
syslog#
```

To enable Syslog services, you must configure at least one host to receive Syslog messages from the router, and at least one entity filter to capture messages for that host.

Configuring a Remote Host to Receive Router Syslog Messages

You must define which remote hosts you want to receive Syslog (event) messages from the router. To define a host, navigate to the **syslog** context and enter:

log-host address *<IP_address>*

IP_address is the address of the remote host to receive Syslog messages.

For example, to point the Syslog service to the remote host at IP address 192.168.3.4, enter:

```
box# syslog
syslog# log-host address 192.168.3.4
log-host/192.168.3.4#
```

You can point the Syslog service to additional remote hosts, up to the value configured for the Syslog maximum-hosts parameter. To increase or decrease the maximum number of hosts, refer to "Defining the Maximum Number of Remote Hosts" on page G-21.

Creating Entity Filters for the Remote Host

After you define a remote host, you must configure at least one entity filter for it. Syslog messaging to that host cannot begin until you create this filter.

To create a filter for a remote host, navigate to the **log-host** context and enter:

filter name *<filter_name>* **entity** *<entity_name>*

filter_name is any name you want to assign to this filter.

entity_name is one of the BCC values for the entity parameter.

Example:

```
box# syslog
syslog# log-host address 192.168.3.4
log-host/192.168.3.4# filter name telnet-sessions entity telnet
filter/192.168.3.4/telnet-sessions#
```

You can configure up to 10 filters per remote host without changing configuration context. For each new filter, reenter the **filter** command with a unique name and any legal value for the entity parameter. To see a list of entity names to use, enter the following command:

```
log-host/192.168.3.7# filter name test entity ?
Legal values:
ace          ahb          all          aot          appn
arp          asr          async        at           atm
atm_dxi      atm_le       atm_sig      atmintf      bgp3
bgp4         bgp          bisync       bod          boot
. . .        . . .        . . .        . . .        . . .
. . .        . . .        . . .        . . .        . . .
. . .        . . .        . . .        . . .        . . .
tcp          telnet       tf           tftp         ti
ti_rui       tnc          token        topology     tty
vst          wcp          wep          x25          x25pad
xctl         xmodem       xns
```

After creating a filter, you need to identify the event numbers, event severity levels, and/or slots to use as filtering criteria. Go to the following sections for that information:

- "Filtering by Event Number" on page G-12
- "Filtering by Event Severity Level" on page G-13
- "Filtering by Slot Number" on page G-15

Filtering by Event Number

Each event message generated by a router entity has a unique number. You can create an entity filter that captures only messages that fall within an event number range that you specify using the following filter parameters:

- event-lower-bound
- event-upper-bound

Syslog includes the upper and lower boundary values as part of this range.

For example, an entity filter for FTP has an event number range with a lower boundary of 5 and an upper boundary of 27. With this filter, Syslog captures and forwards to a remote host all FTP log messages with event numbers 5 to 27.

To filter by event number, navigate to the appropriate entity filter and enter:

event-lower-bound *<event_number>*

event-upper-bound *<event_number>*

event_number is the lowest-numbered event or the highest-numbered event in the range of events you want Syslog to capture.

Example:

```
box# syslog
syslog# log-host/192.168.125.3
log-host/192.168.3.4# filter name telnet-sessions entity telnet
filter/192.168.3.4/telnet-sessions# event-lower-bound 1
filter/192.168.3.4/telnet-sessions# event-upper-bound 52
filter/192.168.3.4/telnet-sessions#
```

To filter a single event, specify the same event number for the event-lower-bound and event-upper-bound parameters.

Accepting the default values for the event-lower-bound (0) and event-upper-bound (255) parameters causes Syslog to use only the severity and slot mask criteria for capturing and forwarding messages.

Filtering by Event Severity Level

Each event message generated by the router software has one of the following severity levels:

- Fault
- Warning
- Information
- Trace
- Debug

You can create an entity filter to capture only event messages that have the severity levels you specify. To create this type of filter:

- Specify a filter name.
- Specify an entity name.
- Set the event-lower-bound parameter to 0.
- Set the event-upper-bound parameter to 255 (the wildcard event number).
- Set the severity-mask parameter to one or more of the following: fault, warning, info, trace, debug.

For example, creating an entity filter for FTP with a message severity-mask value of **{warning fault info}**, captures only FTP event messages with a severity level of warning, fault, or information.

Note: Syslog checks the message severity mask only when you accept the default event message number range of 0 to 255. This causes Syslog to ignore event numbers as criteria for filtering messages.

To set the severity levels for capturing and forwarding event messages to a remote host, navigate to the appropriate filter context and enter:

severity-mask {all | none | <*level*>...}

all specifies all severity levels.

none specifies no severity levels.

level is one or more of the following: **fault**, **warning**, **info**, **trace**, **debug**.

Note: When specifying multiple severity levels (other than **all**), enclose the values in braces (**{ }**) and separate each value with a space.

Examples:

```
filter/192.168.3.4/telnet-sessions# severity-mask {trace}
filter/192.168.3.4/telnet-sessions# severity-mask {fault warning info}
filter/192.168.3.4/telnet-sessions# severity-mask {all}
```

Filtering by Slot Number

The router stores event messages in the log buffer associated with each slot. You can create an entity filter that captures only event messages logged on specified slots. To define a range of slot numbers for an entity filter, you specify values for the following filter parameters:

- slot-lower-bound
- slot-upper-bound

Syslog includes the upper and lower boundary numbers as part of the range. You must specify at least one slot in the range 1 to 14, where the slot numbers depend on the model of router.

Note: Since the slot-lower-bound and slot-upper-bound parameters each have a default value of 0, you must enter a valid, nonzero slot range or the filter will not become active.

For example, you can configure an entity filter for FTP with an event number range of 5 to 27 and a slot number range of 2 to 5. In this case, Syslog forwards to the remote host associated with this filter FTP log messages numbered 5 to 27 logged on slots 2 to 5 only.

You can configure a filter to select messages logged on a specific slot by setting the upper and lower slot boundary values to the same number.

To determine by slot numbers the event messages you want Syslog to capture and forward to a host, navigate to the appropriate filter context and enter:

slot-lower-bound *<slot_number>*

slot-upper-bound *<slot_number>*

slot_number is the lowest-numbered slot or the highest-numbered slot in the range of slots on which you want Syslog to capture event messages.

Example:

```
box# syslog
syslog# log-host/192.168.125.3
log-host/192.168.3.4# filter name telnet-sessions entity telnet
filter/192.168.3.4/telnet-sessions# slot-lower-bound 3
filter/192.168.3.4/telnet-sessions# slot-upper-bound 5
filter/192.168.3.4/telnet-sessions#
```

Note: Although the range for the slot lower and upper boundaries is 0 to 14, specify only values within the range of actual slot numbers for the router model you are configuring. Otherwise, the filter will not become active.

Saving the New Router Configuration to a File

After configuring Syslog, make sure to save the new router configuration. You can save the router configuration in one of two forms:

- As a binary file on an NVFS volume
- As an ASCII file that you import into the router configuration

To save your configuration as a bootable (binary) file on an NVFS volume, enter:

save config *<vol>*:*<filename>*

To save the configuration as an ASCII file, enter:

show config -all -file *<vol:>*:*<filename>*

To import the ASCII file into the router configuration, enter:

source *<vol>*:*<filename>*

Managing Syslog Services

Once you finish configuring Syslog on a router, you may occasionally need to:

- Stop or restart Syslog message forwarding to all remote hosts.
- Stop or restart Syslog message forwarding to a specific remote host.
- Disable or reenable a specific entity filter.
- Delete a remote host from the Syslog configuration.
- Delete an entity filter associated with a specific remote host.
- Delete Syslog services from the router.

Stopping or Restarting Syslog Messaging to All Hosts

You can stop Syslog messaging to all remote hosts by disabling Syslog services. Navigate to the **syslog** context and enter:

disable

Example:

```
box# syslog
syslog# disable
```

To confirm the change, check the current value of the state parameter by entering:

```
syslog# state
 state disabled
```

To restart Syslog messaging to all remote hosts, navigate to the **syslog** context and enter:

enable

Example:

```
box# syslog
syslog# enable
```

To confirm the change, check the current value of the state parameter by entering:

```
syslog# state
 state enabled
```

Stopping or Restarting Syslog Messaging to one Host

You can stop Syslog messaging to a specific host by disabling that host entry in the router configuration. Navigate to the appropriate **log-host** context and enter:

disable

Example:

```
box# syslog
syslog# log-host 192.168.3.4
log-host/192.168.3.4# disable
```

To confirm the change, check the current value of the state parameter by entering:

```
log-host/192.168.125.3# state
 state disabled
```

To restart Syslog messaging, navigate to the appropriate **log-host** context and enter:

enable

Example:

```
box# syslog
syslog# log-host 192.168.3.4
log-host/192.168.3.4# enable
```

To confirm the change, check the current value of the state parameter by entering:

```
log-host/192.168.3.4# state
 state enabled
```

Disabling and Reenabling a Filter

You can stop an entity filter from capturing event messages for its associated remote host. Navigate to the context of the appropriate **filter** object and enter:

disable

Example:

```
box# syslog
syslog# log-host 192.168.3.4
log-host/192.168.3.4# filter/192.168.3.4/telnet-sessions
filter/192.168.3.4/telnet-sessions# disable
```

To confirm the change, check the current value of the filter state parameter by entering:

```
filter/192.168.3.4/telnet-sessions# state
 state disabled
```

To restart Syslog messaging by a specific entity filter, navigate to that filter and enter:

enable

Example:

```
box# syslog
syslog# log-host 192.168.3.4
log-host/192.168.3.4# filter/192.168.3.4/telnet-sessions
filter/192.168.3.4/telnet-sessions# enable
```

To confirm the change, check the current value of the filter state parameter by entering:

```
filter/192.168.125.3/telnet-sessions# state
 state enabled
```

Deleting an Entity Filter from a Configured Host

To delete an entity filter from a configured host, navigate to the appropriate **filter** context and enter:

delete

Example:

```
box# syslog
syslog# log-host/192.168.3.4
log-host/192.168.3.4# filter/192.168.3.4/telnet-sessions
filter/192.168.3.4/telnet-sessions# delete
log-host/192.168.3.4#
```

Notice that the BCC prompt returns to the configuration context of the remote host associated with the filter.

Deleting a Configured Host and Its Filters

To delete a specific remote host entry from the Syslog configuration, navigate to the appropriate **log-host** context and enter:

delete

Example:

```
log-host/192.168.3.4# delete
syslog#
```

Notice that the BCC prompt returns to the **syslog** configuration context. Deleting a remote host automatically deletes all entity filters configured for that host.

Deleting Syslog Services from the Router

To delete all Syslog services from the router, navigate to the **syslog** context and enter:

delete

Example:

```
box# syslog
syslog# delete
box#
```

Notice that the BCC prompt returns to root level (`box#` or `stack#`).

Customizing Syslog Operation

Many Syslog service parameters already have suitable default values. Depending on your specific requirements, you may want to customize settings associated with the following tasks:

- Mapping router event message severity levels to remote host (UNIX) system error levels
- Defining the maximum number of remote Syslog hosts known to the router
- Specifying the interval between polling cycles
- Identifying the system facility used by a specific UNIX host to receive and process Syslog messages from the router
- Enabling sequential Syslog messaging

Mapping Router Message Severity Levels to UNIX System Error Levels

In most cases, you can accept the default mapping between router event severity levels and UNIX system error levels established for a specific filter. However, you can customize these mappings by entering new values for the following parameters of any Syslog entity filter:

- fault-map
- warning-map
- info-map
- trace-map
- debug-map

To change the mapping between router event severity and UNIX system error levels, navigate to the appropriate filter context and enter:

{fault-map|warning-map|info-map|trace-map|debug-map} *<host_error_level>*

host_error_level is one of the following UNIX system error levels: emergency, alert, critical, error, warning, notice, info, or debug.

Example:

```
filter/192.168.3.4/telnet-sessions# warning-map warning
filter/192.168.3.4/telnet-sessions# info-map notice
filter/192.168.3.4/telnet-sessions# fault-map warning
filter/192.168.3.4/telnet-sessions# debug-map debug
filter/192.168.3.4/telnet-sessions#
```

Defining the Maximum Number of Remote Hosts

You can accept the default maximum number of remote hosts configurable on a device (5), or you can navigate to the router's **syslog** context and enter:

maximum-hosts *<maximum_hosts>*

maximum-hosts is the maximum number of remote hosts to allow.

Example:

```
box# syslog
syslog# maximum-hosts 3
```

Specifying the Interval Between Polling Cycles

Syslog polls the events log buffer on each slot to retrieve any new messages logged since the previous polling attempt. Syslog determines this interval by the value of its log-poll-timer parameter.

You can accept the default 5-second interval that Syslog waits to reinitiate a polling cycle across all slots, or you can navigate to the **syslog** context and enter:

log-poll-timer *<seconds>*

seconds specifies the interval between polling cycles.

Example:

```
box# syslog
syslog# log-poll-timer 7
```

Identifying a UNIX System Facility

The value of the log-facility parameter of any configured host determines which UNIX system facility (local0 through local7) receives Syslog messages from the device. You can accept the default setting (local7), or you can navigate to the context of the desired **log-host** object and enter:

log-facility *<system_facility>*

system_facility is one of the following:

local0
local1
local2
local3
local4
local5
local6
local7

Example:

```
box# syslog
syslog# log-host/192.168.3.4
log-host/192.168.3.4# log-facility local4
```

Enabling Sequential Syslog Messaging

Message time-sequencing allows Syslog to capture and forward router event messages in chronological order. Disabling this feature causes Syslog messages to be forwarded according to the polled sequence of slots. (In either case, the UDP transport may disrupt the sequence of messages received by the host.)

This feature is disabled by default, but you can enable Syslog message sequencing for a specific host. To enable Syslog message sequencing, navigate to the context of the desired **log-host** object and enter:

time-sequence enabled

Example:

```
box# syslog
syslog# log-host/192.168.125.3
log-host/192.168.125.3# time-sequence enabled
log-host/192.168.125.3#
```

Syslog Parameter Descriptions

Tables G-1 through G-3 describe parameters for the following BCC configurable objects:

- **syslog**
- **log-host**
- **filter**

Table G-1. Syslog Parameters (box or stack > syslog)

Parameter	Function
log-poll-timer	Specifies the amount of time in seconds that Syslog waits before initiating another cycle to poll all slots for event messages logged since the previous polling cycle
maximum-hosts	Specifies the maximum number of remote hosts you can configure to receive messages from the Syslog service on the router
state	Specifies the administrative state of the Syslog service on the router (enabled or disabled). Before the Syslog service can actually begin filtering and forwarding messages, you must configure at least one remote Syslog host and at least one entity filter for that host.

Table G-2. Parameters of log-host (box or stack > syslog > log-host)

Parameter	Function
address	REQUIRED -- Specifies the IP address of this remote host
log-facility	Specifies the system facility (local0 through local7) used by this remote host to receive Syslog messages from the router.
state	Enables or disables message forwarding to this host from the Syslog service
time-sequence	Enables or disables time-sequencing and forwarding of Syslog messages. Enabling this feature allows Syslog messages from different slots (router-wide) to be interleaved and forwarded sequentially. Disabling this feature causes Syslog messages to be forwarded according to the polled sequence of slots. (In both cases, the inherent unreliability of the UDP transport may disrupt the sequence of messages received by the host.)
udp-port	Specifies the UDP port of this host

Table G-3. Parameters of filter (box or stack > syslog > log-host > filter)

Parameter	Function
debug-map	Maps router debug messages to an equivalent, host system error level: emergency, alert, critical, error, warning, notice, information, or debug.
entity	REQUIRED -- Specifies the router entity logging messages that Syslog will capture and forward to this filter's host
event-lower-bound	Specifies the lowest-numbered event in the range of events that Syslog will capture and forward to this filter's host. If you do not want to filter by event code, accept the default values for the event-lower-bound and event-upper-bound parameters. (This configures the wildcard event range of 0 to 255.) By accepting the wildcard range, Syslog ignores the event-lower-bound and event-upper-bound parameters and checks for filtering criteria based only on the value of the severity mask.
event-upper-bound	Specifies the highest-numbered event in the range of events that Syslog will capture and forward to this filter's host. If you do not want to filter by event code, accept the default values for the event-lower-bound and event-upper-bound parameters. (This configures the wildcard event range of 0 to 255.) By accepting the wildcard range, Syslog ignores this parameter and checks for filtering criteria based only on the value of the severity mask.
fault-map	Maps router fault messages to an equivalent, host system error level: emergency, alert, critical, error, warning, notice, information, or debug
info-map	Maps router info messages to an equivalent, host system error level: emergency, alert, critical, error, warning, notice, information, or debug
name	REQUIRED -- Specifies a unique alphanumeric name for this filter

(continued)

Table G-3. Parameters of filter (box or stack > syslog > log-host > filter) *(continued)*

Parameter	Function
severity-mask	Specifies the severity levels of router event messages -- warning, information, trace, fault, and debug -- that Syslog will capture and forward to this filter's host. Syslog uses this severity mask only if you specify the wildcard event number range (0 to 255) as values for the event-lower-bound and event-upper-bound parameters. If you specify a range of event numbers other than the wildcard range, Syslog ignores the severity-mask parameter.
slot-lower-bound	Specifies the lowest-numbered slot in the range of slots on which Syslog will capture and forward event messages to this filter's host
slot-upper-bound	Specifies the highest-numbered slot in the range of slots on which Syslog will capture and forward event messages to this filter's host
state	Specifies the administrative state of this filter (enabled or disabled)
trace-map	Maps router trace messages to an equivalent, host system error level: emergency, alert, critical, error, warning, notice, information, or debug
warning-map	Maps router warning messages to an equivalent, host system error level: emergency, alert, critical, error, warning, notice, information, or debug

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